TECHNICAL MANUAL
888-2857-001
Platinum VAX-C
Compact Class Transmitter

Platinum VAX-C Compact Class Transmitter Technical Manual

Harris Broadcast

This document covers the following modulations:
ATSC/MH
DVB-T/H
DVBT-2
ISDB-T/H
CTTB
CMMB
DAB
DMB

T.M. No. 888-2857-001

07May2013
Rev: B

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WARNING: Disconnect primary power prior to servicing.

Technical Assistance

Technical and troubleshooting assistance for Harris transmission products is available from Harris field service (factory location: Quincy, Illinois, USA) during normal business hours (8:00 AM - 5:00 PM Central Time). Telephone ***+1-217-222-8200*** to contact the field service department; FAX ***+1-217-221-7086***; or E-mail questions to ***tsupport@harris.com.***
Emergency service is available 24 hours a day, seven days a week, *by telephone only*.
Online assistance, including technical manuals, white papers, software downloads, and service bulletins, is available at ***http://support.broadcast.harris.com/eservice_enu.***
Address written correspondence to Field Service Department, Harris Broadcast, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. For other global service contact information, please visit: ***http://www.broadcast.harris.com/contact***.
NOTE: For all service and parts correspondence, you will need to provide the sales order number, as well as the serial number for the transmitter or part in question. For future reference, record those numbers here: _____/_____
Please provide these numbers for any written request, or have these numbers ready in the event you choose to call regarding any service, or parts requests. For warranty claims it will be required. For out of warranty products, this will help us to best identify what specific hardware was shipped.

Replaceable Parts Service

Replacement parts are available from Harris service parts department from 7:00 AM to 11:00 PM Central Time, seven days a week. Telephone ***+1-217-222-8200*** or email ***servicepartsreq@harris.com*** to contact the Service Parts Department.
Emergency replacement parts are available *by telephone only,* 24 hours a day, seven days a week by calling +1-217-222-8200.

Unpacking

Carefully unpack the equipment and perform a visual inspection to determine if any apparent damage was incurred during shipment. Retain the shipping materials until it has been verified that all equipment has been received undamaged. Locate and retain all packing check lists. Use the packing check list to help locate and identify any components or assemblies which are removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Returns And Exchanges

No equipment can be returned unless written approval and a Return Authorization is received from Harris Broadcast. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with Harris Broadcast, specify the Harris order number or invoice number.

Service Centres

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servicepartsreq@harris.com (parts only)

For other global service contact information, please visit: ***http://www.broadcast.harris.com/contact***.

At Harris Broadcast, we endeavor to offer the finest equipment manuals available today in the broadcast industry. If you encounter errors, omissions, or other areas in which this manual might be improved, we strongly encourage your to send your comments to training@harris.com. Our ability to continually improve our technical documentation depends on your inputs!

Manual Revision History

Platinum VAX-C Compact Class Technical Manual

REV.	DATE	ECN	Pages Affected / Description
A	OCT 2012	P53357	Initial release.
B	07May2013	62739	Updates to Sections 1 2 5

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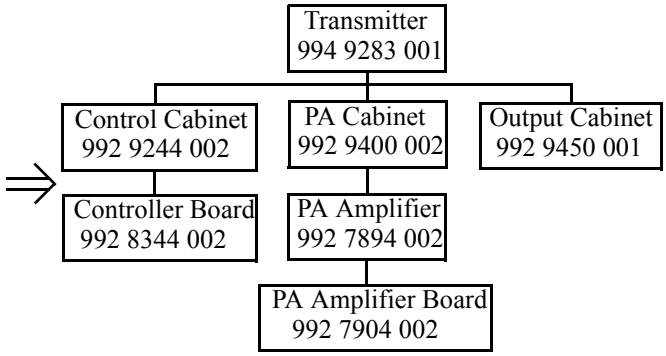
Guide to Using Parts List Information

The Replaceable Parts List Index portrays a tree structure with the major items being left most in the index. The example below shows the Transmitter as the highest item in the tree structure. If you were to look at the bill of materials table for the Transmitter you would find the Control Cabinet, the PA Cabinet, and the Output Cabinet. In the Replaceable Parts List Index the Control Cabinet, PA Cabinet, and Output Cabinet show up one indentation level below the Transmitter and implies that they are used in the Transmitter. The Controller Board is indented one level below the Control Cabinet so it will show up in the bill of material for the Control Cabinet. The tree structure of this same index is shown to the right of the table and shows indentation level versus tree structure level.

Example of Replaceable Parts List Index and equivalent tree structure:

Replaceable Parts List Index	Part Number	Page
Table 7-1. Transmitter	994 9283 001	7-2
Table 7-2. Control Cabinet	992 9244 002	7-3
Table 7-3. Controller Board	992 8344 002	7-6
Table 7-4. PA Cabinet	992 9400 002	7-7
Table 7-5. PA Amplifier	994 7894 002	7-9
Table 7-6. PA Amplifier Board	992 7904 002	7-10
Table 7-7. Output Cabinet	992 9450 001	7-12



The part number of the item is shown to the right of the description as is the page in the manual where the bill for that part number starts. Inside the actual tables, four main headings are used:

- Table #-#. ITEM NAME - PART NUMBER - this line gives the information that corresponds to the
- Replaceable Parts List Index entry;
- P/N column gives the ten digit part number (usually in ascending order);
- DESCRIPTION column gives a 25 character or less description of the part number;
- REF. SYMBOLS/EXPLANATIONS column 1) gives the reference designators for the item (i.e., C001, R102, etc.) that corresponds to the number found in the schematics (C001 in a bill of material is equivalent to C1 on the schematic) or 2) gives added information or further explanation (i.e., “Used for 208V operation only,” or “Used for HT 10LS only,” etc.).

NOTE: Inside the individual tables some standard conventions are used:

- A # symbol in front of a component such as #C001 under the REF. SYMBOLS/EXPLANATIONS column means that this item is used on or with C001 and is not the actual part number for C001.
- In the ten digit part numbers, if the last three numbers are 000, the item is a part that has been purchased and has not manufactured or modified. If the last three numbers are other than 000, the item is either manufactured or is purchased from a vendor and modified for use in the product.
- The first three digits of the ten digit part number tell which family the part number belongs to - for example, all electrolytic (can) capacitors will be in the same family (524 xxxx 000). If an electrolytic (can) capacitor is found to have a 9xx xxxx xxx part number (a number outside of the normal family of numbers), it has probably been modified in some manner at the factory and will therefore show up farther down into the individual parts list (because each table is normally sorted in ascending order). Most made or modified assemblies will have 9xx xxxx xxx numbers associated with them.

The term “SEE HIGHER LEVEL BILL” in the description column implies that the reference designated part number will show up in a bill that is higher in the tree structure. This is often the case for components that may be frequency determinant or voltage determinant and are called out in a higher level bill structure that is more customer dependent than the bill at a lower level.

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Harris Broadcast
PO Box 4290
3200 Wismann Lane 62305

Phone: 217-222-8200
FAX: 217-221-7096

PARTS ORDER FORM

Billing Information

Customer Name: _____

Address: _____

_____

_____

_____

Telephone: _____

FAX: _____

Preferred

Payment Method : _____

Frequency & Channel: _____

Equipment Part Number:_____

Equipment Serial Number:_____

Shipping Information

Ship To (If different from billing information):

_____

Address: _____

_____

_____

_____

Telephone: _____

FAX: _____

Preferred

Shipping Method : _____

Guide for Ordering Parts: Please provide as much information as possible to facilitate part substitution as required. Equipment name, part number and serial number is found on a metal ID plate on the rear of the unit. Describe the unit using the parts list if possible. Include schematic information, schematic number, or number of next higher assembly. The next higher assembly usually has a part number that begins with a 9xx-xxxx-xxx.

Item	Quantity	Part Number	Description of Part - Part's Name, Description, and Specification from Parts List	Ref Des e.g. C21, R100, etc.	Item Used On - Assembly if Known e.g. C21 used on 992-8025-001 & Schematic 839-8038-991	Comments

WARNING:
THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY WARNINGS, INSTRUCTIONS AND REGULATIONS.

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care. Harris Broadcast shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks. During installation and operation of this equipment, local building codes and fire protection standards must be observed.

The following National Fire Protection Association (NFPA) standards are recommended as reference:

- Automatic Fire Detectors, No. 72E
- Installation, Maintenance, and Use of Portable Fire Extinguishers, No. 10
- Halogenated Fire Extinguishing Agent Systems, No. 12A

WARNING:
ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS, PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR WHEN FATIGUED.

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don't take chances.

WARNING:
IN CASE OF EMERGENCY ENSURE THAT POWER HAS BEEN DISCONNECTED.

IF OIL FILLED OR ELECTROLYTIC CAPACITORS ARE UTILIZED IN YOUR EQUIPMENT, AND IF A LEAK OR BULGE IS APPARENT ON THE CAPACITOR CASE WHEN THE UNIT IS OPENED FOR SERVICE OR MAINTENANCE, ALLOW THE UNIT TO COOL DOWN BEFORE ATTEMPTING TO REMOVE THE DEFECTIVE CAPACITOR. DO NOT ATTEMPT TO SERVICE A DEFECTIVE CAPACITOR WHILE IT IS HOT DUE TO THE POSSIBILITY OF A CASE RUPTURE AND SUBSEQUENT INJURY.

WARNING:
THERE IS DANGER OF EXPLOSION AND CHEMICAL EXPOSURE IF THE BATTERY IS NOT HANDLED, REMOVED, AND INSTALLED PROPERLY.

WARNING:
BATTERIES MUST NOT BE DISPOSED OF WITH DOMESTIC WASTE! SEND USED BATTERIES BACK TO THE MANUFACTURER OR SUPPLIER.

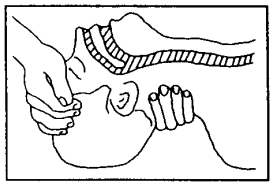
TREATMENT OF ELECTRICAL SHOCK

1. IF VICTIM IS NOT RESPONSIVE FOLLOW THE A-B-CS OF BASIC LIFE SUPPORT.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

(A) AIRWAY

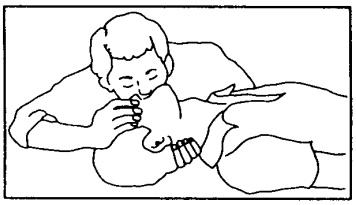
IF UNCONSCIOUS,
OPEN AIRWAY



LIFT UP NECK
PUSH FOREHEAD BACK
CLEAR OUT MOUTH IF NECESSARY
OBSERVE FOR BREATHING

(B) BREATHING

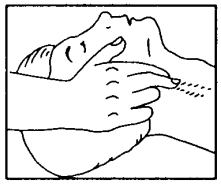
IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL
4 QUICK FULL BREATHS

REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS POSSIBLE

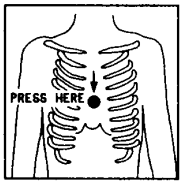
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

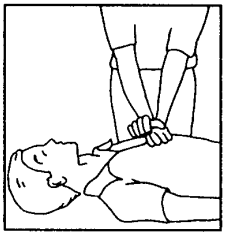
(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



APPROX. RATE OF COMPRESSIONS --80 PER MINUTE
- ONE RESCUER
- 15 COMPRESSIONS
- 2 QUICK BREATHS

APPROX. RATE OF COMPRESSIONS --60 PER MINUTE
- TWO RESCUERS
- 5 COMPRESSIONS
- 1 BREATH



NOTE: DO NOT INTERRUPT RHYTHM OF COMPRESSIONS
WHEN SECOND PERSON IS GIVING BREATH

CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE.

2. IF VICTIM IS RESPONSIVE.

A. KEEP THEM WARM
B. KEEP THEM AS QUIET AS POSSIBLE
C. LOOSEN THEIR CLOTHING
D. A RECLINING POSITION IS RECOMMENDED

WARNING: Disconnect primary power prior to servicing.

FIRST-AID

Personnel engaged in the installation, operation, maintenance or servicing of this equipment are urged to become familiar with first-aid theory and practices. The following information is not intended to be complete first-aid procedures, it is a brief and is only to be used as a reference. It is the duty of all personnel using the equipment to be prepared to give adequate Emergency First Aid and there by prevent avoidable loss of life.

Treatment of Electrical Burns

1. Extensive burned and broken skin
    a. Cover area with clean sheet or cloth. (Cleanest available cloth article.)
    b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
    c. Treat victim for shock as required.
    d. Arrange transportation to a hospital as quickly as possible.
    e. If arms or legs are affected keep them elevated.

NOTE:
If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold). Allow victim to sip slowly about 4 ounces (a half of glass) over a period of 15 minutes. Discontinue fluid if vomiting occurs. (Do not give alcohol.)

2. Less severe burns - (1st & 2nd degree)
    a. Apply cool (not ice cold) compresses using the cleanest available cloth article.
    b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
    c. Apply clean dry dressing if necessary.
    d. Treat victim for shock as required.
    e. Arrange transportation to a hospital as quickly as possible.
    f. If arms or legs are affected keep them elevated.

REFERENCE:
ILLINOIS HEART ASSOCIATION
AMERICAN RED CROSS STANDARD FIRST AID AND PERSONAL SAFETY MANUAL (SECOND EDITION)

Glossary of Terms

Analog Input Board (AIB):

An optional circuit card for the modulator section of the low power unit (LPU). It provides the necessary interface to allow the modulator to accept analog video and audio inputs according to the PAL, NTSC, or SECAM standards.

ASI (Asynchronous Serial Interface):

A streaming format used to carry the MPEG transport stream from the network origination point to the transmitter for modulation onto the RF carrier(s).

ATSC (Advanced Television Subcommittee):

A digital television standard featuring a single, vestigial-sideband carrier and an 8-VSB modulation constellation. The transport stream format may be either

SMPTE310 or ASI:

The data rate before forward error correction is 19.392658 Mbit/s. The transmitted data rate with error correction is 32.28 Mbit/s.

Back Porch:

The portion of the analog video horizontal line waveform following the sync pulse but before the start of active video.

Band III:

The VHF radio frequency band from 174 MHz to 230 MHz. In this manual, taken to mean the broadcast band from 168 MHz to 242 MHz covered by the VAX transmitter.

BPF (Band pass filter):

A high power filter centered about the desired channel bandwidth and located at the transmitter output port to eliminate out-of-band intermodulation products arising from the power amplification process. Also commonly referred to as the mask filter or critical mask filer.

CAN (Controller Area Network):

A serial communications standard designed to allow microcontrollers and devices to communicate with each other.

COFDM (Coded Orthogonal Frequency Division Multiplex):

A transmission technique in which the information content of a complete ensemble (multiplex) is divided and modulated onto a multitude of closely neighboring RF carriers within a channel bandwidth (frequency block). The division of the information payload among a large number of RF carriers ensures that each individual RF carrier has a very low data rate (symbol rate). The long symbol period of the individual RF carriers allows the receiver to wait until all delayed signal reflections have arrived and been added to the direct signal (...during a guard interval to be discarded). This permits recovery a stable signal in difficult reception conditions, especially during mobile reception.

CRC (Cyclic Redundancy Checksum):

A procedure for error detection in digital signals. Before distribution to the transmitter, a CRC is computed for the transport stream signal. This CRC is sent in the transport stream. Upon reception at the transmitter site, another CRC is computed from the received transport stream and compared to the transmitted value. If the CRCs are identical, no error has occurred during the distribution to the transmitter site.

DAB Mode (Digital Audio Broadcast):

A digital radio/multimedia standard for transmitting multiple programs within a 1.5 MHz RF frequency block. The original DAB standard has been extended by two different enhancements to the encoding layer: DAB-Plus and DMB. All three standards use the original DAB modulation format in the transmitter (changes are upstream in the encoder). Four different DAB modes exist. All VAX transmitters use DAB mode I.

DAC (Digital Analog Converter):

A circuit that converts digital values inside the processing stages of the LPU modulator into analog RF waveforms for amplification and transmission by the transmitter.

dBm (Decibels over 1 milliwatt):

A logarithmic signal power measurement scale referenced to 1 mW. 0 dBm is equivalent to 1 mW. 10dBm = 10mW, 20dBm = 100mW, 30dBm = 1000mW.

DMB (Digital Multimedia Broadcasting):

A modification of the basic DAB system according to ETSI standard (TS 102 427 and TS 102 428) using MPEG-4 (H.264) and BSAC/HE-AAC V2 compression to

permit sending of multimedia information (radio, TV, and data casting) to mobile devices such as mobile phones. Originally developed in South Korea.

DUC (Digital Upconverter):

A circuit in the LPU modulator section that converts the digital modulated baseband signal to the 140 MHz digital intermediate frequency.

Dynamic Delay:

A processing function provided in the exciter to compensate for different delays of the program data stream in the data distribution network between the network origination point and various transmitter sites. A time-stamp contained in the transport stream serves as a reference. The present time is delivered by a GPS receiver at the transmitter (1pps signal, rising slope). Comparing these two sources, the dynamic delay function is able to synchronize the program input to all transmitters over a one-second correction range.

Ensemble:

The complete information payload being received and processed by the transmitter, typically when transmitting according to the DAB standard. In general, the ensemble includes audio programs, data services, and possibly video content.

ETI (Ensemble Transport Interface):

The transport stream format for DAB/DMB broadcasting (2.048 Mbit/s, G.703) used to send program material from the ensemble provider to all DAB transmitters in a network. The ETI format has two varieties: ETI-NA and ETI-NI.

ETI(NA) (Network Adapted Layer):

A protocol is suited for transmitting the ETI signal via telecom networks. It has a frame structure that complies with G.704 specifications and contains error protection information (Reed Solomon Code). The bit clock frequency is 2.048 MBit/s.

ETI(NI) (Network Independent Layer):

A protocol is suited for transmission with connections that have a low error rate and a constant signal delay. It does not contain any error protection information. The bit clock frequency is 2.048 MBit/s.

ETI Input Board (EIB):

An optional circuit card for the modulator section of the low power unit (LPU). It provides the necessary interface to allow the modulator to accept ETI transport streams according to the DAB digital transmission standard.

Ethernet:

The physical interface by which the VAX transmitter may be connected to a LAN and/or the Internet to provide web-based supervision. It generally employs an RJ45 connector.

EVM (Error Vector Magnitude):

A measure used to quantify the performance of the quality the digital being transmitted. A signal sent by an ideal transmitter would have all constellation points precisely at the ideal locations. However, various imperfections in the signal path cause the actual constellation points to deviate from the ideal locations by finite error vectors. Generally associated with the ATSC modulation standard. Analogous to the modulation error ration (MER) used for the DVB, DAB and other modulation standards.

FPGA (Field Programmable Gate Array):

An integrated circuit designed to be configured by the customer or designer after manufacturing. FPGAs perform many of the intensive digital processing steps used to synthesize the transmitted RF signal in the LPU modulator section.

GPS (Global Positioning System):

A satellite-based navigation system commonly used for determining position and navigating. In a single frequency network context, it delivers an extremely precise time reference (UTC... universal time, coordinated) used to synchronize all transmitters.

Guard Interval:

A time interval at the start of each transmitted symbol in a digital COFDM system. Distortions to the received signal due to time-delayed reflections or interfering transmitters falling in this interval are ignored by the receiver.

GUI (Graphical User Interface):

A type of user interface that allows users to interact with electronic devices via images rather than text commands. In this application, the user interface provided by the TCU touch screen in dual drive systems or the web-based remote interface served over the Ethernet interface.

Hierarchical modes:

A transmission technique whereby the transmitted data payload is divided into a lower data rate high priority (HP) stream and a higher data rate low priority (LP) stream. Those receivers with difficult reception conditions decode only the more robust HP data stream, while receivers with good reception conditions receive both data streams.

Hot-pluggable:

Term to denote that the device in question can be removed while transmitter is operating without suffering damage or causing damage to other devices.

HTML (Hypertext Markup Language):

The predominant markup language for web pages. HTML is the basic building block of web pages.

IP Address (Internet Protocol Address):

A numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol (IP) for communication. An IP address serves two principal functions: host or network interface identification and location addressing.

LCD (Liquid Crystal Display):

A thin, flat electronic visual display that uses the light modulating properties of liquid crystals to display text and images. In the VAX transmitter, the blue display screen on the front panel of the low power unit(s).

LPF (Low Pass Filter):

A high power filter located at the transmitter output port used to attenuate out-of-band emissions at the signal harmonic frequencies arising from the high power amplification process. May also be referred to as a harmonic filter.

LPU (Low Power Unit):

May also be referred to as the exciter. The LPU contains both an upper, modulator section and a lower, amplifier section.

MER (Modulation Error Ratio):

A measure used to quantify the performance of the quality the digital being transmitted. A signal sent by an ideal transmitter would have all constellation points

precisely at the ideal locations. However various imperfections in the signal path cause the actual constellation points to deviate from the ideal locations by finite error vectors. The modulation error ratio quantifies the ratio of the desired signal to the undesired error vectors. MER is typically associated with COFDM modulation formats such as DVB or DAB.

MCM (Master Control Module):

A circuit card in the transmitter control unit (TCU) in dual drive systems. The MCM card provides most of the core control functions, whereas the TCU card controls the user remote & GUI interface.

PA (Power amplifier):

An electronic circuit that accepts a low level RF signal and outputs an amplified replica.

PAB (Power amplifier block):

A high power amplifier stage. May refer to the LPU power block (PAB zero in lower-half amplifier section of LPU chassis) or one or more external high power amplification stages (PAB 1…4).

PCB (Printed Circuit Board):

A circuit board in the transmitter.

PCM (Processor Control Module):

A circuit card in the transmitter control unit (TCU) in dual drive systems. The MCM card provides most of the core control functions, whereas the TCU card controls the user remote & GUI interface.

PFRU (Precise Frequency Reference Unit):

A circuit sub-assembly inside the LPU modulator section responsible for supplying the various high-stability oscillator signals required to synthesize the transmitted RF waveform.

PRBS (Pseudo-random binary sequence):

An endless series of random numbers typically used for transmitter test purposes, often when a valid transport stream does not exist.

PS (Power supply):

A device that supplies DC electrical energy to one or more electric loads, typically via the rectification of an AC mains electrical input.

RF (Radio frequency):

An electrical oscillation at the frequency of radio waves in the range of 3 kHz to 300 GHz. In this application, typically a signal in the 168 MHz to 242 MHz frequency range of the VAX transmitter.

RS-485:

A TIA/EIA standard for serial multipoint communications lines. The signal communication protocol used for serial communications between various subassemblies in the transmitter system. Also known as EIA-485 or TIA-485.

RTAC (Real Time Adaptive Correction):

A signal processing technique applied in the modulator signal generation stage which seeks to correct deficiencies in the high power amplification and filtering stages by means of complementary pre-distortion.

RU:

An abbreviation for rack unit.One rack unit equals 1.75" (44.45mm). The rack unit is used to describe the height of components that will be placed in racks.

SFN (Single Frequency Network):

A transmission network in which all transmitters are synchronized in frequency and phase (symbol). This transmission technique guarantees high frequency economy, as a single frequency can be used in a large geographic area.

SMA (SMA connector):

A coaxial connector for RF cables featuring a 0.250 x 36 thread and a .312 inch (7.925mm) hex nut in the male connector.

SMPTE (SMPTE 310 transport stream):

A transport stream format sometimes employed with the ATSC digital television standard.

Static Delay:

A delay function provided by the exciter over a manually settable range of 0 to 1000 ms to compensate for differences in signal processing delays or local propagation conditions for individual transmitters in a single frequency network.

Sync (Sync pulse):

The horizontal synchronization pulse in the video waveform which, when transmitted, creates the highest level of peak envelope power in the transmitter.

TII (Transmitter Identification Information):

A data field transmitted during the null in the DAB RF frame containing transmitter identification information for use by the receiver. Each transmitter in a single frequency network has its own unique TII identifier.

Time stamps:

Data fields in the transmission protocol (e.g. in the ETI signal) containing timing information for the purposes of signal monitoring and synchronization.

TS (Transport Stream):

A standard format for transmission and storage of audio, video, and data for broadcast systems such as DVB and ATSC. The transport stream specifies a container format encapsulating packetized elementary streams, with error correction and stream synchronization features for maintaining transmission integrity when the signal is degraded. Depending on the digital transmission standard, the transport stream may be in the SMPTE310, ASI, or ETI format.

TPO (Transmitter Power Output):

The desired transmitter forward output power level.

UDC (Up-Down Converter):

A circuit in the LPU modulator section that converts an 140 MHz intermediate frequency signal to the final desired VHF RF channel frequency (upconversion) or vice versa (downconversion)

UPS (Uninterruptable Power Supply):

A battery-based system designed to provide power during an AC mains failure event.

VGA (Video Graphics Array):

A video display standard used by the personal computer industry based on a 640 x 480 pixel resolution. The standard used by the TCU touchscreen in dual drive systems.

VHF (Very High Frequency):

The radio frequency range of 30 MHz to 300 MHz. In this application, the 168 MHz to 242 MHz frequency band covered by the VAX transmitter.

WEB:

A device or interface that uses HTML formatted documents transmitted according to the IP protocol, typically over LAN/WAN/Internet servers, but also locally via 1:1 communications.

References

Please also consult the following references for additional information on DAB technical requirements:

- TR 101 496: "Digital Audio Broadcasting (DAB); Guidelines and rules for implementation and operation"
- ETS 300 401: ”Radio broadcast systems; Digital Audio Broadcasting (DAB) to mobile, portable, portable and fixed receivers”
- ETS 300 799: "Digital Audio Broadcasting (DAB); Distribution Interfaces; Ensemble Transport Interface (ETI)"
- ITU-T Recommendation G.703: “General Aspects of Digital Transmission Equipment; Terminal Equipment. Physical/electrical Characteristics of Hierarchical Digital Interfaces, Geneva, 1994”
- ITU: “Radio Regulations, Appendix 8, Geneva, 1994”

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Section 1 Introduction

1

1.1 Purpose of Manual

This manual provides important information for the proper operation and maintenance of the VAX family of air cooled, solid state, VHF transmitters. Schematics and diagrams are provided in an accompanying drawing package. This manual is written for the skilled broadcast maintenance technician and assumes previous experience working with RF broadcast equipment. The various sections of this technical manual provide the following types of information:

- Section 1: Introduction, identifies the versions of the product available and the possible options.
- Section 2: Installation, details the procedures to receive, install, and commission the transmitter for use, including initial start-up procedure.
- Section 3: Operation, describes operation of the equipment and is intended to be the primary section referenced by operating personnel.
- Section 4: Theory of Operation, is included to help service personnel understand the inner workings of the transmitter.
- Section 5: Maintenance, lists and explains alignments and adjustments that could be required to maintain the transmitter.
- Section 6: Troubleshooting, included as a service aid to be used along with Sections 4 and 5 by qualified service personnel to identify and correct an equipment malfunction.
- Section 7: Parts List, a comprehensive listing of the components that may be replaced in the field.

NOTE:
If a "customer-special" manual is included with a custom-built transmitter, the information in that manual supercedes that contained in this manual.

WARNING: Disconnect primary power prior to servicing.

1.2 VAX-C Features / Benefits

The Harris VAX-C Compact Class transmitter offers the following useful features and benefits:

- Easy migration between different modulation standards. Nearly all digital TV and DAB/DMB standards are available by software upgrade.

NOTE:
If different modulation standards are required, then a new feature key must be entered into the controller to activate additional modulation types and options. Contact Harris sales to obtain information and pricing for new feature keys.

- Rugged, reliable design and construction - Compact design utilizing only 2 RU (rack unit) space.
- New 50-volt LDMOS device technology delivers a dramatic increase in power density.
- PowerSmart technology, for best-in-class power efficiency and lowest operating costs
- Digital power levels 5 to 100 W COFDM, 5 to 150 W DAB, 5 to 180 W ATSC
- All-digital linear and non-linear pre-correction utilizing Real-Time Adaptive Correction (RTAC™)
- Fully Broadband PA Modules — VHF, bands III, 168 to 242 MHz
- Automatic restart after AC mains interruption - returns to previous operational mode
- Modular control system for straightforward monitoring and in-depth diagnostics
- Harris® web-enabled remote GUI interface

1.3 General Description

This section contains a general description of the Platinum VAX-C Series of television transmitters. Included in this section will be descriptions of the control system, amplifier, block diagrams of the various models and system specifications.

The VAX-C series of solid state, air cooled, transmitters is designed to synthesize and amplify radio- frequency signals in the VHF broadcast bands III (168 to 242 MHz).

VAX-C transmitters contain the following assemblies: control panel, exciter, controller and amplifier. The major components are shown in Figures 1-1, 1-2 & 1-3.

Figure 1-1 VAX-C Transmitter - Front Panel

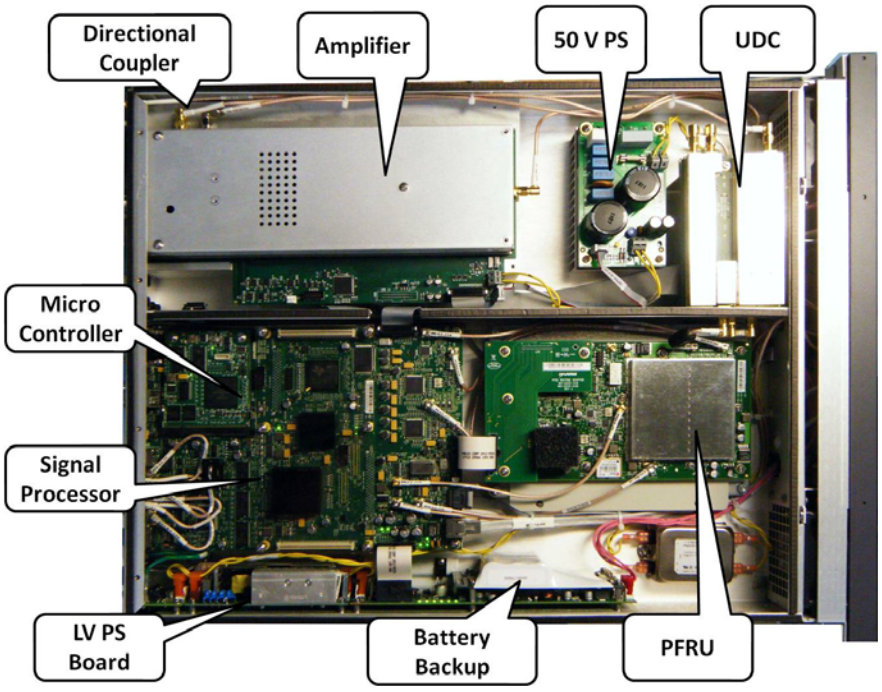


Figure 1-2 VAX-C Transmitter - Top (cover removed)

WARNING: Disconnect primary power prior to servicing.

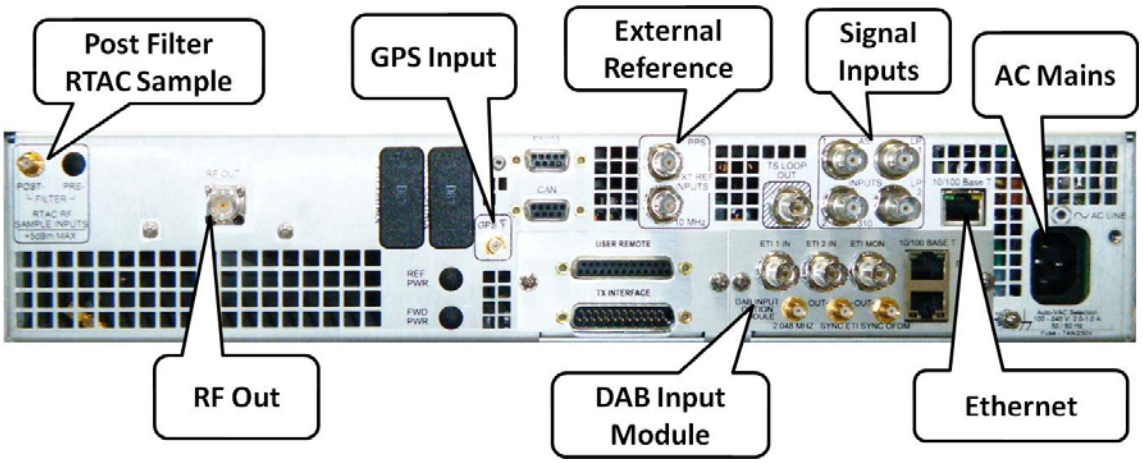


Figure 1-3 VAX-C Rear Panel

The Platinum VAX-C series of solid state, air-cooled transmitters is designed to synthesize and amplify radio frequency signals in the VHF TV and DAB/DMB broadcast band III 168-242 MHz.

As of this printing, VAX transmitters support the following TV and radio formats:

DAB = Digital Audio Broadcasting

DABPlus = Digital Audio Broadcasting

DMB = Digital Multimedia Broadcasting

ATSC = American Television Standards Committee DTV

ATSC A110 = Single frequency network standard for ATSC

ATSC-M/H = Mobile TV standard for ATSC

ISDB-T = South American and Japanese digital DTV

DVB-T = Digital Video Broadcasting – Terrestrial

DVB-T2 = Digital Video Broadcasting – Terrestrial

DVB-H = Digital Video Broadcasting – Handheld

CMMB = Chinese multimedia standard

CTTB(DTMB) = Chinese multimedia standard

WARNING: Disconnect primary power prior to servicing.

1.4 Transmitter Models

VAX-C transmitter model numbers are formed based on the following:

'V' stands for VHF Band, while 'A' means that air is used for cooling, 'X' indicates that the unit is a TV Transmitter, and 'C' stands for compact class. The number following the VAX prefix stands for the transmitter power level. The suffix indicates the modulation type. The suffix 'AT' indicates 'ATSC'. Other abbreviations include: MH for ATSC Mobile Handheld, DV for 'DVB-T/H', T2 for DVB-T2, IS for 'ISDB-T', CT for CTTB, CM for 'CMMB', DA for DAB, and DM for DMB digital modulations standards. The suffix set will be extended for additional modulation standards as required.

For example:

VAX-180AT-C = VHF, air cooled, TV transmitter, 180W, compact class, ATSC (digital)

VAX-100DV-C = VHF, air cooled, TV transmitter, 100W, compact class, DVB-T (digital)

The Platinum VAX-C Compact Class transmitters are available in four air cooled power levels. The models are listed below in Table 1-1.

Table 1-1 Platinum VAX-C DAB Transmitter Models

Tx Models	Configuration	Output Power (average)
VAX-75DA-C	2RU	75 W
VAX-150DA-C	2RU	150 W
NOTES: All power levels given in average power at the transmitter output (pre-filter). RU = rack unit. 1RU = 4.45 cm (1.75")		

Table 1-2 Platinum VAX-C COFDM TV Transmitter Models

Tx Models	Configuration	Output Power (average)
VAX-50XX-C	2RU	50 W
VAX-100XX-C	2RU	100 W
NOTES: All power levels given in average power at the transmitter output (pre-filter). RU = rack unit. 1RU = 4.45 cm (1.75")		

NOTE:
In the table above the suffix XX is an indicator of modulation type. The following suffixes are used: DV=DVB-T/H, T2=DVB-T2, IS=ISDB-T, CT=CTTB, CM=CMMB.

Table 1-3 Platinum VAX-C ATSC Transmitter Models

Tx Models	Configuration	Output Power (average)
VAX-90AT-C	2RU	90 W
VAX-180AT-C	2RU	180 W
NOTES: All power levels given in average power at the transmitter output (pre-filter). RU = rack unit. 1RU = 4.45 cm (1.75")		

1.5 VAX Transmitter System

VAX-C transmitters feature solid-state design and utilize a FET-based power amplifier (PA) module to amplify the RF signal. In addition to RF drive power from the exciter stage, the PA module utilizes 50V DC power, supplied by a switch mode power supply (PS) module.

The PA module type varies with power level. The VAX-C features two cooling fans that can be changed by removing the front panel while the transmitter is on-air. Transmitters are typically supplied without a rack. Rack mounting is available as an option.

The VAX-C system control is provided by the microprocessor daughter board which is mounted on the signal processing board, as shown in Figure 1-2 on page 1-3. SNMP communications and IP connectivity are standard offerings and available in all transmitter models. The VAX-C transmitter has an LCD display and control buttons on the front panel to allow the user to locally control the transmitter as shown in Figure 1-1 on page 1-3. LCD panel and push button control provides limited control of the transmitter system. The feature key and modulation settings can't be changed using the LCD control panel push buttons. The web browser must be used to change these parameters.

1.5.1 Transmitter RF Power Control

The PA module itself operates in open loop mode (no gain or level adjustment). The transmitter RF power control is done via automatic level control located in the VAX-C upconverter.

1.5.2 Software

The transmitter is shipped from the factory with software preloaded and ready to run. If a software update is required, follow the instructions in the maintenance and alignment section. Software can be easily updated using the web browser and ISP (In System Programming). ISP is a Harris programming utility that is selectable as part of the web browser interface. See 3.4.1 for further details.

1.5.3 Remote Control

The Platinum VAX-C transmitter has a wired parallel remote control with the standard connections for control, status and analog monitoring located on the customer I/O card in the rear panel. Detailed information on the remote control connections to the VAX-C and cabinet can be found in Section 2.7.

WARNING: Disconnect primary power prior to servicing.

Platinum VAX-C transmitters include a Web enabled remote GUI interface that provides comprehensive remote control and monitoring of data points within the transmitter. It includes an SNMP (simple network management protocol) manager which allows integration with most control systems via the Internet or LAN.

1.6 Operating Voltages

Single phase, 100 to 240 V AC, auto-ranging, +/-10%, 50/60 Hz, one IEC C15 inlet.

CAUTION:
CHECK THE AC POWER FEEDING THE VAX-C. IT MUST BE BETWEEN 100 VAC AND 240 VAC +/-10%. ANY VOLTAGE OUTSIDE THAT RANGE WILL CAUSE DAMAGE TO THE EQUIPMENT. THE VOLTAGE SHOULD BE MEASURED LINE TO LINE, OR WHEN A NEUTRAL IS USED, LINE TO NEUTRAL.

CAUTION:
IF VOLTAGE VARIATIONS IN EXCESS OF +/-10% ARE ANTICIPATED, THE TRANSMITTER POWER INPUT MUST BE EQUIPPED WITH AUTOMATIC VOLTAGE REGULATORS (OPTIONAL EQUIPMENT) CAPABLE OF CORRECTING THE MAINS VOLTAGE.

1.7 Block Diagram

Figure 1-4 on page 1-9 contains a system block diagram showing the basic RF signal flow and configuration for a Platinum VAX-C transmitter.

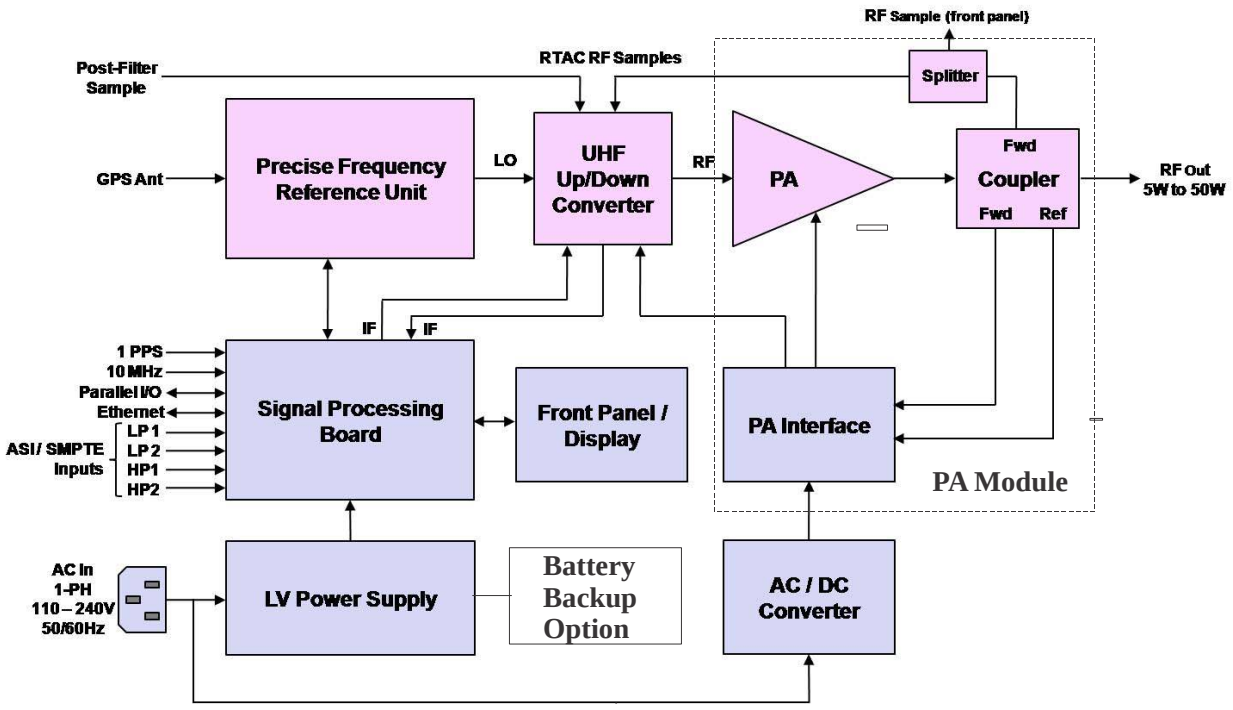


Figure 1-4 VAX-C Simplified Block Diagram

WARNING: Disconnect primary power prior to servicing.

1.8 Transmitter Accessories

The VAX-C chassis contains the basic VAX transmitter. Additional options are available and may be present in a VAX-C transmitter system. In as much as these accessories do not significantly change the functioning of the core transmitter itself, it is understood that this manual addresses customized transmitter configurations that may contain one or more of these options.

In the case of a relatively high level of customization, this manual may also be accompanied by a supplemental “customer-special” manual. In the case where conflicting information is presented in the two manuals, the information given by the customer-special manual supersedes any information contained in this manual.

1.8.1 Rack Integration

VAX-C digital transmitters are purchased as an individual component (sometimes referred to as stand alone models) and can be mounted in an equipment rack provided by the customer. Harris can provide a complete rack integration package, including filters and other RF components. The VAX-C needs to have rear support as the back of the unit has the majority of the weight, adjustable rack rails can be provided by Harris to support the VAX-C in a rack.

1.8.2 Directional Coupler or Wattmeter

Optional precision directional couplers are available. A through-line wattmeter capable of measuring the output power directly may be supplied as another option. External couplers are required to provide sample ports for test and monitoring equipment. An additional directional coupler is required after the filter to provide a signal source for RTAC operation.

1.9 VAX-C Exciter/Controller

The VAX-C exciter section is a transmitter RF signal source. It receives the program material to be transmitted in the form of a digital transport stream and generates a low-level on-channel RF signal. It performs pre-corrections for non-linear distortions which occur in the transmitter RF power amplifier and for linear distortions/group delay which occur in the high power filter.

The VAX-C can be operated with multiple digital modulation platforms by changing the software and updating the feature key (feature key updates may not be required, it depends on how the system was initially purchased).

The heart of the VAX control system is a microprocessor daughter board located on the signal processing board in the VAX-C chassis. The front of the VAX-C includes a control panel and LCD screen. There are two RJ45 ethernet connectors. One ethernet connector is located on the front control panel. This connector has a static IP address and acts as a DHCP server. The other RJ45 ethernet connector is on the rear of the unit and can be configured as a DHCP client or assigned a static network IP.

The VAX-C contains two muffin fans mounted in the right and left sides of the chassis front. Cooling air is drawn into the assemblies from the front and forced over the top and bottom sides of the circuit boards, and exits from the rear of the VAX-C exciter section. The left fan cools the exciter part of the unit and the right fan cools the PA section. The fans are not redundant.

The VAX-C top cover may be removed to provide access to the circuit boards, power should be disconnected before the top cover is removed. See Figure 1-2 on page 1-3 for the names and locations of the various circuit boards in the VAX-C.

All system interconnections are via the rear panel, see Figure 1-3 on page 1-4.

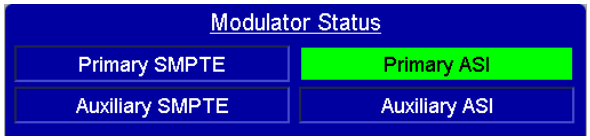
A vertical column of seven LEDs on the front panel provide status for TS Input, Drive Chain, Power Amp, Power Supply, Output, System and Mute. Refer to Section 3.1.3 on page 3-6 for descriptions of the front panel LEDs.

1.9.1 Inputs and Outputs

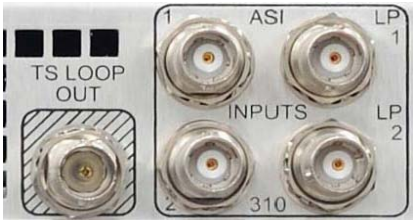
The RF output can be set to any VHF channel and the output power is maintained via automatic level control (ALC).

The VAX-C has four digital input program streams via the rear panel BNC input connectors, shown in Figure 1-5. Most modulation standards only use two of them at a time as a main and alternate inputs. The program inputs may be ASI or SMPTE310

depending on the modulation standard. See section 3 for modulation dependent input connector configurations. The modulation process is fully digital, with analog circuits used after the D/A converter to up-convert the IF signal to the desired channel.



ATSC Modulator Status Screen
Transport Stream Indicators



Rear Panel Transport Stream
Input Connectors

Figure 1-5 Transport Stream Input Presence Indicators and Rear Panel Input Connectors

The VAX-C upconverter will produce an RF output that can be set to any VHF channel and may be adjusted to any level up to 6dBm average power when operated in the digital mode.

NOTE:
In a VAX-C transmitter, the adjusted output of the exciter will determine the overall system output power. The output power of the exciter should not exceed 6dBm. The output power of the upconverter will vary depending on the desired transmitter output power, as well as the gain of the PA(s) that are in the system.

The VAX-C can accept a 10 MHz external frequency standard input or a 1PPS (Pulse Per Second) input via rear-panel, BNC, connectors. An SMA (female) GPS input is also available. An external standard is used whenever the user requires increased frequency precision, or a precise frequency offset. Use 1PPS or GPS input for SFN operation.

The VAX-C uses RTAC™ (Real Time Adaptive Correction) to monitor and manage pre-correction for the transmitter system's linear and nonlinear distortion. No manual correction circuits are employed. Low power RF samples from various stages of the transmitter are required by the RTAC circuits.

1.10 VAX-C Specifications

NOTE:
Specifications subject to changed without notice. Unless otherwise noted, these specifications apply at the output of a Harris supplied mask filter.

1.10.1 General Specifications

Table 1-4 General Specifications

Item	Specification
RF Output Frequency Range	VHF Band III, 168 to 242 MHz
ATSC A110	Single frequency network standard for ATSC
RF Input Samples for Adaptive	1 x SMA, 50 ohms; dynamic range: -20 to +5 dBm
Transport Stream Inputs	2 x BNC, 75 ohms terminated (50 ohms connector per ASI rec.), configurable as SPMTE 310M, DVB-ASI, or DVB-T2MI 2 x BNC, 75 ohms terminated (50 ohms connector per ASI rec.), additional for DVB-ASI hierarchical modulation
10 MHz Reference Input	1 x BNC, 50 ohms
1 PPS Reference Input	1 x BNC, 50 ohms/Hr-2
10 MHz Reference Output	1 x SMA, 50 ohms, front access
1 PPS Reference Output	1 x SMA, 50 ohms, front access
Ethernet	1 front, RJ-45, customer access 1 rear, RJ-45, DHCP enabled network interface (SNMP)
Parallel Remote Control	1 rear, user remote 1 rear, transmitter interface
Serial Connectivity	1 rear CAN interface 1 rear RS-232
GPS Antenna Input	1 x SMA, 50 ohms, rear access (option)
RF Monitor Output	1 x SMA, 50 ohms, front access
AC Power Input	Single Phase, 100 to 240 VAC, auto-ranging, +/-10%, 50/60 Hz
Power Factor	>0.95

WARNING: Disconnect primary power prior to servicing.

Table 1-4 General Specifications

Item	Specification
Environmental	32° to 113° F (0° to 45° C) up to 6,560 ft (2,000 m) AMSL, de-rate 3.6° F (2° C) per 984 ft (300 m) of elevation. 95% relative humidity, non-condensing
Physical (H X W x D)	2RU x 19" x 23" (2RU x 483 mm x 584 mm); 2RU= 3.5" (88.9 mm)
Weight	25 lbs (11.3 kg) excluding packing
Compliance	RoHS 2002/95/EC R&TTE 1999/5/EC Safety: EN 60215 EMC: EN 301-489-1 FCC Part 73, A/153 CE Marked

1.10.2 COFDM Specifications

Table 1-5 COFDM Transmitter Specifications (DVB-T/T2, ISDB-T, CMMB)

Item	Specification
Power Output (before filter)	50 W, 100 W
Output Power Reduction	0 dB to -10 dB
Power Stability	±0.5 dB
Shoulder Level	<-37 dB
MER	>34 dB
END	≤0.7dB
Frequency Stability	±150 Hz/month without PFC/GPS <0.5 Hz per 1% supply variation <50 Hz over ambient temperature range <100 Hz at 5 minutes during warm up
Frequency Offsets[1]	Any frequency within band plan, 1Hz increments
Standards	DVB-T: ETSI EN 300 744 DVB-T2: ETSI EN 302 755 ISDB-Tb: Brazil ANATEL standard CTTB: CMMB:
Response Variation	0.2 dB, typical
Phase Noise	10 Hz <-55 dBc/Hz 100 Hz <-85 dBc/Hz 1 kHz <-90 dBc/Hz 10 kHz <-95 dBc/Hz 100 kHz <-112 dBc/Hz 1 MHz <-130 dBc/Hz
Spurious Output	-60dB (after mask filter)
Spectrum Mask	Per standard. Filters for critical and non-critical mask available
Central Carrier Suppression	>75 dB relative to average power
Note 1: High-stability external 10 MHz reference or optional built-in GPS required for SFN	

WARNING: Disconnect primary power prior to servicing.

1.10.3 ATSC Specifications

Table 1-6 ATSC Transmitter Specifications

Item	Specification
Power Output (before filter)	40 W, 180 W
Output Power Reduction	0 dB to -10 dB
Power Stability	±0.5dB
Shoulder Level	<-35dB
EVM	>27dB (<4%)
Frequency Stability[1]	±150 Hz/month without PFC/GPS <0.5 Hz per 1% supply variation <50 Hz over ambient temperature range <100 Hz at 5 minutes during warm up <±3Hz with internal or external GPS clock
Frequency Offsets	Any frequency within band plan, 1Hz increments
Standards	ATSC: A/53 & A/110B
Input Bit Rate	19.39 Mbit/s
Response Variation	0.2 dB, typical
Phase Noise	<-104 dBc/Hz @ 20kHz offset (ATSC A/64)
Spurious Output	Meets FCC 5th and 6th report and order
Spectrum Mask	Per ATSC standard
Note 1: High-stability external 10 MHz reference or optional built-in GPS required for SFN	

1.10.4 DAB/DMB Specifications

Table 1-7 DAB/DMB Transmitter Specifications

Item	Specification
Power Output (before filter)	75 W, 150 W
Output Power Reduction	0 dB to -10 dB
Power Stability	±0.25 dB
MER	DAB/DMB (OFDM) ETSI TR101 496-1 25 dB MER prior to optional mask filter.
Frequency Stability	$<5x10^{-10}$ per day (OCXO aging)
Standards	DAB ETSI EN 302077
Response Variation	0.2 dB, typical
Phase Noise	10 Hz <-55 dBc/Hz 100 Hz <-85 dBc/Hz 1 kHz <-90 dBc/Hz 10 kHz <-95 dBc/Hz 100 kHz <-112 dBc/Hz 1 MHz <-130 dBc/Hz
Harmonics/Spurious Output	Complies with EN 302077-2 when used in conjunction with filter having following attenuation specifications: Critical mask: fc +/- < 768 kHz: < 1.0 dB fc +/- 970 kHz: > 15 dB fc +/- 1.75 MHz: > 45 dB fc +/- > 3 MHz: > 45 dB fc +/- > 10 MHz: > 50 dB Non-critical mask: fc +/- < 768 kHz: < 1.0 dB fc +/- 970 kHz: > 0 dB fc +/- 1.75 MHz: > 15 dB fc +/- > 3 MHz: > 45 dB fc +/- > 10 MHz: > 50 dB Shoulder before filter: 35 dB min., >36-40 dB typical (compensated). Mask specification is dependent on output power of transmitter per EN303077-2.
ETI Inputs/Outputs	BNC-female 75 ohm. 2x ETI(NA, G704) resp. 2 x ETI(NI, G703) seamless input signal switch-over automatic. ETI(NI) select.2.048 Mb/s, unbalanced / balanced with optional 2 Mb adaptor.
GPS Input	SMA-female, 50 ohm, 1.57542 GHz, -130 to -100 dBm. (+5 V DC @ 100 mA max output for active antenna)

WARNING: Disconnect primary power prior to servicing.

Table 1-7 DAB/DMB Transmitter Specifications

Item	Specification
1 pps input	BNC-female, 50 ohm (high Z), TTL level
Reference Frequency Input	SMA-female, 50 ohm, 0.1/0.5/1/2.048/5/10 MHz, -7 to + 15 dBm
Monitoring Outputs	- ETI OUT - ETI-frame - RF monitor (low power stage) - 1 Hz (1 pps signal) - Reference frequency 10 MHz - Incident and reflected signal Tx output (optional)

WARNING: Disconnect primary power prior to servicing.

Section 2 Installation / Initial Turn-On

2

2.1 Introduction

This section includes the information necessary for installation and initial turn on of a Platinum VAX-C, solid state, air cooled, VHF TV transmitter. Due to the modular nature of the VAX-C, all models have similar installation and testing procedures.

2.2 Unpacking

Upon receipt of the transmitter shipment, carefully unpack the transmitter and perform a visual inspection to ensure that no apparent damage was incurred during shipment. Retain the shipping materials until it has been determined that the unit is not damaged. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete or if the unit is damaged electrically or mechanically, notify the carrier and Harris Corporation, Broadcast Division.

2.3 Returns and Exchanges

Damaged or undamaged equipment should not be returned unless written approval and a Return Authorization is received from HARRIS CORPORATION, Broadcast Division. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with Harris Corporation, Broadcast Division, specify the Harris Order Number or Invoice Number.

WARNING: Disconnect primary power prior to servicing.

2.4 Documentation

The following is a list of documentation that ships with the transmitter. Find and save all documentation.

A Document Package includes:

1. Technical manual
2. Drawing Package with a set of applicable system level schematics for the transmitter system
3. Application notes and manuals for ancillary equipment may be packed individually with system components.

2.4.1 Technical Manual and Drawings

Review the technical manual and drawing package to become familiar with installation and planning information provided there.

Table 2-1 Platinum VAX-C System Drawings

Drawing Title	Drawing Number
Drawing Package	917-2323-235
Wiring Diagram, VAX-CC	843-5618-002

2.5 Installation

NOTE:
This equipment is intended only for installation in a RESTRICTED ACCESS LOCATION.

Steps in the installation section are numbered in each section. As each step is completed, the step number can be circled to indicate completion. This provides a quick confidence check at the end of the procedure that no steps were skipped.

NOTE:
In case of discrepancy between the connections listed in diagrams versus information given in this installation section, the wiring information in the diagrams should be considered the most accurate. *All connections listed in this section should be verified with the schematics before initial turn on.*

When performing the installation, after the transmitter is in place, plan to run the transmitter output transmission lines first, then the air cooling system components (if ducting is used), and finally the electrical conduit runs.

NOTE:
If air handling duct work is to be installed, plan all of the RF and conduit runs to leave room for the duct work.

The reason for this installation order is that rigid coax runs need to be installed using minimum elbows. Installation of RF lines is more complicated if obstacles like conduit, and ductwork are in place. The RF lines should have a minimum number of elbows for best performance.

NOTE:
RF coaxial lines must be properly supported.

2.5.1 Transmitter Placement and Operating Environment

The selection of a proper installation location is essential for equipment longevity and reliability. Do not install the transmitter in places where it may be exposed to mechanical shocks, excessive vibration, dust, water, or acidic gas.

Ambient temperature and relative humidity should always range between the following limits at the installation location:

- Ambient temperature: 0 to +45^{o}C. (0 to +40^{o}C. for UL 60950)
- Relative humidity: 0 to 90% non-condensing

NOTE:
Failure to follow these installation instructions may void the warranty.

The transmitter should be placed where it will have adequate room to access the front and rear panels. There are several drawings included in the drawing package to help plan the transmitter placement:

STEP 1 Open the box and remove the packing material that surrounds the transmitter.

STEP 2 Place the transmitter in position.

2.5.2 Rack Mounting Components

In many instances, VAX-C transmitter components will ship without a mounting rack. The transmitter may be installed in customer supplied equipment racks. In these instances, it is the customer's responsibility to properly support and mount the equipment in the racks. Equipment installed in racks must be properly installed on shelves or use brackets that safely and adequately support the weight of the equipment.

WARNING:
EQUIPMENT RACKS AND TRANSMITTER COMPONENTS MUST BE PROPERLY GROUNDED. SEE 2.6.3 ON PAGE 2-5 AND 2.6.4 ON PAGE 2-7 FOR GROUNDING DETAILS.

2.6 Transmitter AC and Ground Connections

NOTE:
AC connections will be similar across all Platinum VAX-C models. Be sure to verify all connections using the correct schematic drawings.

The VAX-C does not have an AC ON/OFF switch. Power is applied to the unit by plugging an energized power cord into the AC connector (IEC C15) on the back of the unit. All VAX-C power levels will operate over a voltage range of 100 - 240VAC, 50-60 Hz, and is auto ranging.

2.6.1 Surge Suppression Devices

Harris strongly recommends the use of surge protection devices on the incoming AC mains lines. These devices protect against damages due to transients arising from both natural and man-made sources. (e.g. lightning and inductive load switching). Clear preference is to be given to “series” type surge protection devices -- featuring protection by both a series inductance / shunt capacitor filter and shunt threshold device -- over simple shunt-only clamping devices. The surge protector must be sized to handle the full amperage of the load it is protecting (plus a nominal safety margin) and be connected to the building ground system by short, direct connections. In the case where the shunt protection elements are protected by a fuse, it is necessary to periodically check the integrity of the fuse to ensure continued transient protection.

2.6.2 Voltage Regulation

If voltage variations in excess of +/-10% are anticipated, the transmitter power input must be equipped with automatic voltage regulators (optional equipment) capable of correcting the mains voltage.

2.6.3 Safety Ground

The VAX-C stand-alone transmitter is equipped with a safety ground lug connection on the rear panel just below the AC connection (see Figure 2-1). This safety ground should be connected to the site ground system.

WARNING: Disconnect primary power prior to servicing.

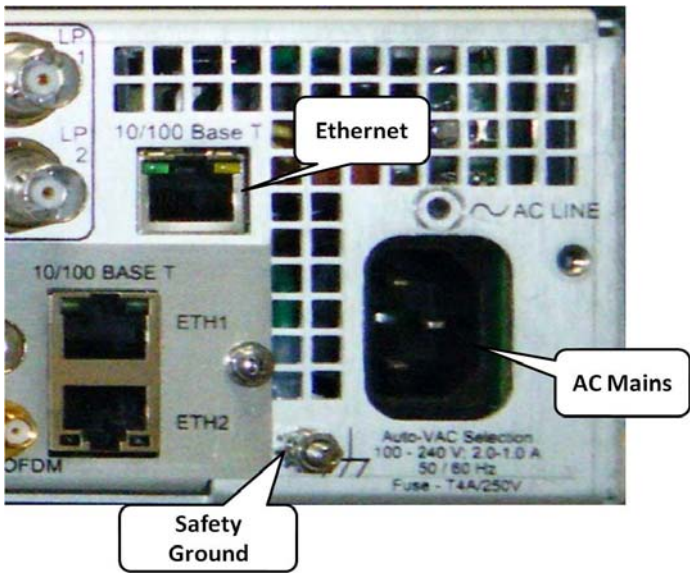


Figure 2-1 VAX-C Safety Ground Connection (without rack)

A safety ground wire is required for each AC mains input and they should be connected to the station ground system.

In instances where the VAX-C is installed in customer or harris supplied racks each component should have a safety ground connection to the rack.

WARNING: Disconnect primary power prior to servicing.

2.6.4 Cabinet Ground Strap

Connect a ground strap from the cabinet's copper ground buss bar (shown in Figure 2-2) to the station ground. The copper strap must be at least 5cm wide and 0.5mm thick. To prevent ground loops, do not connect this strap to the ground of another piece of equipment, but instead, connect directly to the main station ground system.

Figure 2-2 Typical Cabinet Ground Strap Connection

2.6.5 Connecting AC Power

CAUTION:

CHECK THE AC POWER THAT WILL FEED THE VAX-C. IT MUST BE BETWEEN 100 VAC AND 240 VAC +/-10%. ANY VOLTAGE OUTSIDE THIS RANGE WILL CAUSE DAMAGE TO THE EQUIPMENT. THE VOLTAGE SHOULD BE MEASURED LINE TO LINE, OR IF A NEUTRAL IS USED, LINE TO NEUTRAL.

WARNING:

AN EXTERNAL CIRCUIT PROTECTION DEVICE (BREAKER OR FUSE) IS REQUIRED FOR EACH COMPONENT AC INPUT. THIS IS PROVIDED BY THE CUSTOMER IN ACCORDANCE WITH THE AC INTERCONNECT DRAWING OR BY HARRIS IF AN IN-RACK AC DISTRIBUTION CHASSIS IS PURCHASED (OPTIONAL). IN THE LATTER

CASE, AN EXTERNAL CIRCUIT PROTECTION DEVICE TO HANDLE THE ENTIRE TRANSMITTER LOAD AT THE MAIN AC DISTRIBUTION POINT IS STILL REQUIRED, IN ACCORDANCE WITH PREVAILING LOCAL SAFETY NORMS.

⚠ WARNING:
USER SHOULD NOT ALTER OR DISCONNECT ANY PROTECTION DEVICES.

⚠ CAUTION:
WHEN THE SINGLE PHASE INPUTS TO THE TRANSMITTER ARE DERIVED FROM A WYE (STAR) MAINS SERVICE, SPECIAL CARE MUST BE PAID TO THE NEUTRAL CONNECTION, AS THE NEUTRAL CONNECTION SERVES AS THE COMMON VOLTAGE REFERENCE TO ALL THREE PHASES. SHOULD THE NEUTRAL CONNECTION BREAK, THE LINE-TO-LINE VOLTAGE OF EACH PHASE WILL BECOME UNSTABLE AND INVARIABLY RESULT IN SEVERE DAMAGE TO ALL LOADS FROM AN OVER-VOLTAGE CONDITION. ACCORDINGLY, ALL NEUTRAL CONNECTIONS SHOULD BE DOUBLE CHECKED FOR INTEGRITY, ESPECIALLY WHEN MODULAR MAINS DISONNECT PLUGS ARE IN USE. NEVER ALLOW THE NEUTRAL TO BE BROKEN BEFORE THE INVIDUAL LINE CONNECTIONS. THIS RECOMMENDATION HOLDS FOR ALL SINGLE-PHASE EQUIPMENT WITH A 380-415V WYE-DERIVED FEED, NOT JUST THE HARRIS VAX TRANSMITTER.

STEP 1 Confirm presence of safety ground wire connection as shown in Figure 2-1.

STEP 2 Unplug the AC power connector from the rear of the VAX-C.

STEP 3 Activate the AC mains supplying the AC power connector.

STEP 4 Use an AC voltmeter to confirm the AC voltage. It should stable and between 100 and 240VAC.

STEP 5 After confirming the voltage on the connector, plug it in to the VAX-C rear IEC15 port. The AC connector is shown in Figure 2-1.

STEP 6: The LCD and the LEDs on the front panel should light.

⚠ CAUTION:
DO NOT PRESS THE TRANSMITTER FRONT PANEL ON BUTTON UNTIL THE RF CONNECTIONS DEFINED IN Section 2.10 HAVE BEEN MADE.

2.7 Signal and Sample Connections

This section contains descriptions of signal and sample connections on the rear of the VAX-C transmitter.

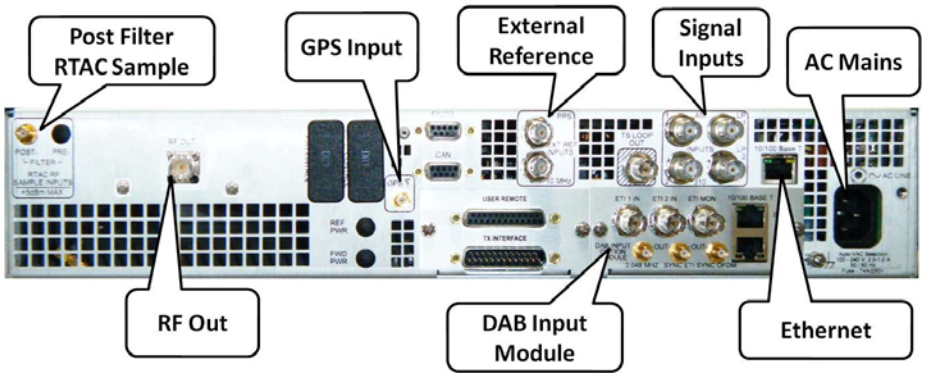


Figure 2-3 VAX-C Rear Panel

2.7.1 Rear Panel Connections

Table 2-2 Rear Panel Connections

Connection	Description
GPS ⏄ (SMA)	GPS antenna input to the internal GPS receiver. Provides +5 VDC at 0.15 Amps maximum for an amplified GPS antenna. GPS receiver normal signal input level is -130 dBm to -100 dBm, its antenna input impedance is 50 ohms, and its center frequency is 1.57542 GHz.
POST-FILTER (SMA)	RTAC RF input signal connector for an RF sample from output of high power filter. It is used by RTAC ™ (Real Time Adaptive Correction) to correct for the linear distortions of the output filter. Normal input signal range is -20 to +5 dBm. The input impedance is 50 ohms.
RS232	Female 9 Pin D sub connector. It is used to communicate with various computer applications.
CAN	Female 9 Pin D sub connector. This connector is used for the CAN (Controller Area Network) interface to some transmitters.
1 PPS INPUT	BNC, female connector is the one pulse per second input from an external GPS receiver. This is a TTL pulse which is typically 100 nsec wide, and is read at the leading edge. Accuracy requirement is 15 nsec.

WARNING: Disconnect primary power prior to servicing.

Table 2-2 Rear Panel Connections

Connection	Description
10MHZ REF INPUT	BNC, female connector is the (optional) 10 MHz reference frequency input. It is used when precise control of the exciter's pilot frequency is required. Normal signal input range is -10 to +10 dBm. The input impedance is 50 ohms.
USER REMOTE	25 pin, female, D sub connector. See pinout in Table 2-3 below.
TRANSMITTER INTERFACE	25 pin male D sub connector. See pinout in Table 2-4 below.
TS LOOP OUT	Female BNC connector is an output sample of the on the air ASI or SMPTE signal
10/100 Base T	RJ45 connector is the rear panel Ethernet connector. This connector can be set to the DHCP mode.
RF Out	50 ohm, type N, female connector. RF output up to 50 W depending on model.

WARNING: Disconnect primary power prior to servicing.

2.7.2 User Remote Connector

This 25 pin female connector is labeled 'User Remote' and located on the rear panel. It can be used for remote control and monitoring on standalone transmitters (non-racked systems).

Table 2-3 Rear Panel, 'User Remote' Connector

User Remote - 25 Pin Female				
	Signal	**Direction**	**Description**	**Control I/O Assignment**
1	Forward Power	Output	0 – 4.096VDC output representing Forward power level	Analog Output 0
2	Reflected Power	Output	0 – 4.096VDC output representing reflected power level	Analog Output 1
3	Spare Analog In 1	Input		Analog Input 2
4	Spare Analog In 2	Input		Analog Input 3
5	+12Vdc	Output	+12Vdc, 200mA max	
6	GND		Ground	
7	GND		Ground	
8	GND		Ground	
9	GND		Ground	
10	GND		Ground	
11	Alarm O Common		Alarm 0 Relay Common	
12	Alarm 0 Normally Closed		Alarm 0 Relay Normally Closed (Faulted) Position	
13	Alarm 0 Normally Open		Alarm 0 Relay Normally Open (Non-Faulted) Position	
14	Alarm 1 Common		Alarm 1 Relay Common	
15	Alarm 1 Normally Closed		Alarm 1 Relay Normally Closed (Faulted) Position	
16	Alarm 1 Normally Open		Alarm 1 Relay Normally Open (Non-Faulted) Position	
17	Alarm 2 Common		Alarm 2 Relay Common	
18	Alarm 2 Normally Closed		Alarm 2 Relay Normally Closed (Faulted) Position	
19	Alarm 2 Normally Open		Alarm 2 Relay Normally Open (Non-Faulted) Position	
20	Alarm 3 Common		Alarm 3 Relay Common	
21	Alarm 3 Normally Closed		Alarm 3 Relay Normally Closed (Faulted) Position	
22	Alarm 3 Normally Open		Alarm 3 Relay Normally Open (Non-Faulted) Position	
23	Alarm 4 Common		Alarm 4 Relay Common	
24	Alarm 4 Normally Closed		Alarm 4 Relay Normally Closed (Faulted) Position	
25	Alarm 4 Normally Open		Alarm 4 Relay Normally Open (Non-Faulted) Position	

WARNING: Disconnect primary power prior to servicing.

NOTE:
The alarms noted in the above table report the following functions and are mapped to the Front Panel LEDs as follows:

- **Alarm 0:** Output/Mute (If either Output or Mute LED is RED or ORANGE, Alarm is Faulted.)
- **Alarm 1:** System (If System LED is RED or ORANGE, Alarm is Faulted.)
- **Alarm 2:** Power Supply (If Power Supply LED is RED or ORANGE, Alarm is Faulted.)
- **Alarm 3:** Drive Chain/Power Amp (If either Drive Chain or Power Amp LED is RED or ORANGE, Alarm is Faulted.)
- **Alarm 4:** TS Input (If TS Input LED is RED or ORANGE, Alarm is Faulted.)

2.7.3 Transmitter Interface Connector

The 25 pin, male, connector is labeled Transmitter Interface and located on the VAX-C rear panel. It can be used for remote control and monitoring on standalone transmitters.

Table 2-4 Rear Panel, 'Tx Interface' Connector

LPU TX Interface Connector -25 Pin Male				
	Signal	**Direction**	**Description,**	**Control I/O Assignment**
1	/Power Raise	Input	Power Raise Command	I/O Bus 0
2	/Power Lower	Input	Power Lower Command	I/O Bus 1
3	TX On	Input	Transmitter On Command	I/O Bus 2
4	/TX Off	Input	Transmitter Off Command	I/O Bus 3
5	Not Used	Input		I/O Bus 4
6	/RF Mute Command	Input	RF Mute Command	Indirectly to Signal Processing board
7	/Sum Fault	Output	Summary Fault Status	I/O Bus 5
8	/RF Mute Status	Output	RF Mute Status	I/O Bus 6
9	/UPS Shutdown	Input	Disables battery backup functionality	Indirectly to Signal Processing board
10	/EQ Reset	Input	Resets adaptive correction tables to default	I/O Bus 16
11	EQ/Hold	Input	Holds current adaptive correction tables	I/O Bus 7
12	Not Used	Input		Analog Input 0
13	Not Used	Input		Analog Input 1
14	Not Used	Input		I/O Bus 8
15	/RF Present	Output	Indicates that the exciter RF output is valid	I/O Bus 9
16	On/Off Status	Output	Transmitter On/Off Status	I/O Bus 10
17	/Remote Fault Reset	Input	Restrike Command	I/O Bus 11
18	Not Used	Input		I/O Bus 12
19	Not Used	Input		I/O Bus 13
20	Exciter/LPU Sum Flt	Output	Exciter LPU Summary Fault Status	I/O Bus 14
21	Remote Enable/Disable	Output	Remote Control Status	I/O Bus 15
22	GND		Ground	
23	GND		Ground	
24	GND		Ground	
25	GND		Ground	

2.7.4 TS (Transport Stream) Connections

The TS input connectors are type BNC, female. TS input connector impedances are 75 ohms. Belden 8281 or similar high-quality video cable can be used to deliver this signal to the VAX-C over a distance of up to 1000 feet.

Figure 2-4 Rear TS & Ethernet Connections

Table 2-5 TS Inputs

Connector Label	ATSC	DVBT/CTTB/CMMB/ ISDBT	DVBT Hierarchial
1	ASI Primary	ASI Primary	ASI High Priority Primary
2	ASI Auxiliary	ASI Auxiliary	ASI High Priority Auxiliary
LP 1	SMPTE Primary	Not used	ASI Low Priority Primary
LP2	SMPTE Auxiliary	Not used	ASI Low Priority Auxiliary

2.8 External Interlock

Due to VAX-C output power levels, an external interlock is not currently provided. If an external interlock is required, please contact Harris.

2.9 Cooling System

The VAX-C contains two 12V fans in the front of the unit. The front panel contains washable filter material which should be in place when the unit is operating.

The front panel can be removed for maintenance while the transmitter is operating but the panel should be in place during normal operation. The 12Vdc fans can be changed while the transmitter is operating. See Section 5.7 on page 5-23 for replacement instructions.

NOTE:
Prior to start-up, the cooling fans should be visually checked to make sure there are no obstructions.

Job site environmental conditions should be evaluated periodically to assure filter cleanliness. Schedule maintenance activities to accommodate changing environmental conditions at the site. See Section 5.8 on page 5-24 for instructions on cleaning filters.

NOTE:
Special note concerning stand alone units: Rack selection is key to maintaining proper cooling of stand alone units. To provide proper cooling, a rack with ample venting through the front and rear doors should e selected to ensure proper air flow from the front and rear of the rack.

2.10 RF Connections

2.10.1 RF Output

Prior to operation the transmitter RF output connector must be connected to a known good test load or antenna with a high quality 50 ohm RF cable. A patch panel may also be used if switching between load and antenna is desired.

A type N male connector is needed for the transmitter output side of the cable. The VAX-C output connection is located on the rear panel see Section Figure 2-5 on page 2-17. The connector needed for the load, filter or antenna end of the cable may vary depending on the customer's system. Initial testing into a 50 ohm test load is recommended. VSWR (voltage standing wave ratio) of the test load should be <1.05:1, antenna system <1.2:1, and filter <1.1:1. The VAX-C will operate into a VSWR of 1.5:1 maximum but a lower system VSWR is recommended for reliable operation.

2.10.2 RF Sample Connections and Level

An RTAC post-filter RF feedback signal is required for RTAC to perform linear precorrection. If the unit is running in RTAC stored mode then this post-filter sample is not required.. The RF sample input connector is located on the VAX-C rear panel and shown in Figure 2-5. The feedback sample is taken from the directional coupler located after the system mask filter. If no mask filter is used or required then the feedback should be via a coupler at the output of the system. The coupler can be ordered from Harris as an option. If the transmitter system is a 1+1 (main/standby) configuration, feedback samples for each transmitter are obtained by splitting the post filter sample cable.

With the transmitter operating at full TPO the post-filter RTAC sample signals at the VAX-C input should be padded to yield a nominal 0 to -5 dBm at the highest expected transmitter output power. The post filter sample input power range is -20 to +5 dBm.

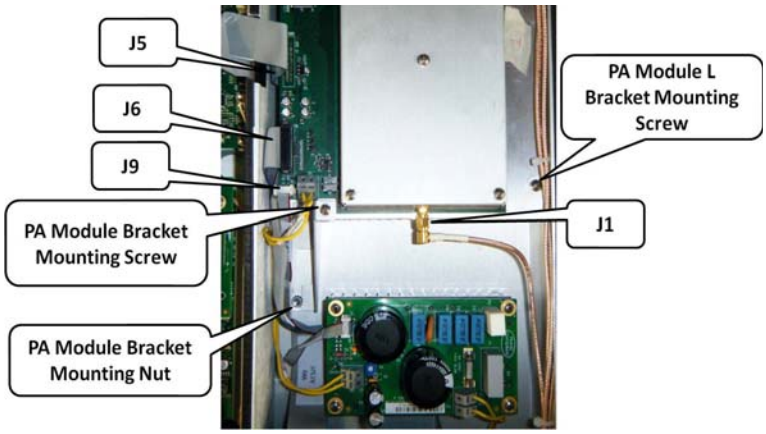


Figure 2-5 VAX-C RF Connections

WARNING: Disconnect primary power prior to servicing.

2.11 Transmitter Power Up

The VAX-C transmitter is now ready to produce RF power. The critical setup steps have been performed. Some additional setup may be required to setup transport stream handling, set RTAC states, system references, etc.

If valid transport streams are not present RF output may be inhibited for DVB-T systems. In that case, the user must connect to the transmitter with a PC and web browser in order to activate the PRBS test mode in the modulation setup pages.

Other modulation types do not require a valid TS to produce output as long as the modulator settings are correct. This procedure does not attempt to describe modulator settings (web browser Setup screens) that need to be set for the various modulation types. For more detailed setup instructions refer to the transmitter technical manual (section three).

The initial transmitter power up is as follows:

STEP 1 Refer to information provided above to confirm that grounding, AC power, signal inputs, load or antenna hook-up and initial setup steps have been performed.

⚠ CAUTION:
THE VAX-C TRANSMITTER MUST BE CONNECTED TO A KNOWN GOOD LOAD OR ANTENNA BEFORE TURNING IT ON.

STEP 2 Disconnect the post-filter RF sample line at the VAX-C rear panel.

STEP 3 Press the Power menu button below the LCD screen to display the forward and reflected power levels.

STEP 4 Press the ON button on the transmitter front panel to activate RF power.

STEP 5 Press the Raise button on the front panel to slowly increase the transmitter power to full TPO while monitoring forward and reflected levels on the LCD Power screen.

STEP 6 Check the RF power level at the post filter RF sample line where they connect to the transmitter rear panel.

STEP 7 Use pads to set the level within the -20 to +5 dBm range (-5dbm optimal)

STEP 8 Connect the post filter RF sample line at the rear panel of the VAX-C transmitter.

STEP 9 Use the LCD screen and control buttons to set RTAC to Adapt mode. Navigate to Setup>Adaptive>Power on LIN and set to Adapt. Navigate to Setup>Adaptive>Power on NON-LIN and set to Adapt.

STEP 10 It may take a few minutes for RTAC to adapt and correct the signal.

STEP 11 End of procedure.

2.12 Battery Backup Activation

Units that ship with the optional battery backup (UPS) system installed will have a connector/jumper installed on the Tx Interface connector on the UAX-C chassis rear panel.

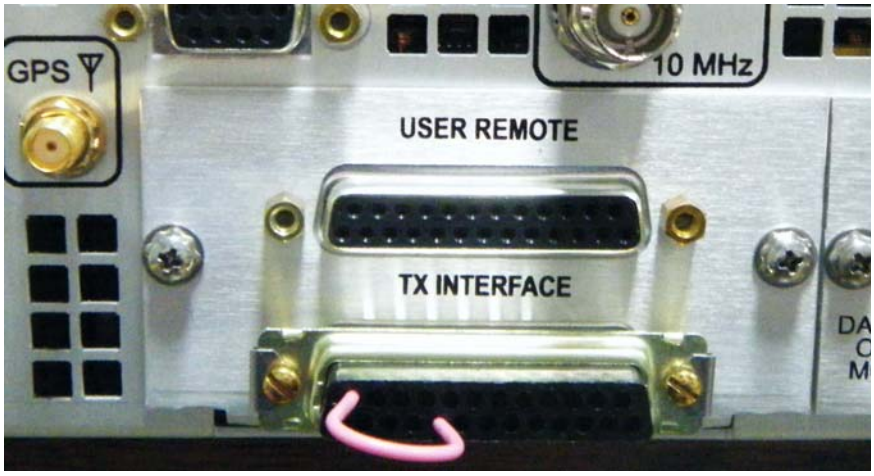


Figure 2-6 Battery Backup (UPS) Jumper

Once the transmitter has been placed into service the battery backup connector/jumper can be removed to activate the battery backup (UPS) system. Retain the connector/ jumper for future use should the transmitter be placed in storage or shipped to another location.

WARNING: Disconnect primary power prior to servicing.

Section 3 Operation

3

3.1 Transmitter Control

This section gives detailed operational information for the Platinum VAX-C Series Solid-State VHF TV transmitter. Information pertains to the operation and navigation of the front panel controls and the web interface.

The VAX-C can be operated from the LCD control panel on the front of the unit or with the web browser interface which is accessed via computer. The LCD and control buttons on the front of the unit can be used to control and monitor most transmitter operations. However, in order to control the modulation settings a computer must be connected to the VAX-C's front or rear RJ45 ethernet connector. The computer can be connected directly (front panel connection) or via a network connection to the rear panel.

The web browser interface can be used either remotely if the VAX-C is connected to a network or locally by connecting to the RJ45 Ethernet port on the rear of the VAX-C. Simply enter the IP address of the VAX-C into the web browser. The IP address can be found either at the bottom of the LCD Power screen or by navigating to the Setup > Remote Comms screen on the LCD.

The default user name is **admin**. The default password is **admin**.

The ethernet port on the front of the VAX-C can also be used, but it has a fixed IP address which is 192.168.117.88. See Section 5.12.4, Connection Via Front Ethernet Connector, on page 5-34 for additional information on VAX-C Ethernet connections.

WARNING: Disconnect primary power prior to servicing.

3.1.1 Transmitter Control Panel

The VAX-C transmitter front control panel is shown in Figure 3-1. It contains an LCD screen, control buttons and LED's.

Figure 3-1 VAX-C Front Panel.

Table 3-1 Front Panel Control Buttons

Field	Explanation
STATUS	Displays the Status Menu.
POWER	Displays model number, forward/reflected power levels and allows selection of linear and non-Linear correction - Stored, Adapt, Hold or Bypass.
SETUP	Displays the set-up menus on the LCD.
UP/DOWN/LEFT/ RIGHT	Used for LCD menu navigation. The up and down buttons are used to move the arrow cursor, which indicates the menu line that will be activated by pressing the black enter button. The left button is primarily used as a back button to return to a previous menu selection.
ENTER	This is the black button in the center of the UP/DOWN/LEFT/RIGHT buttons. Used to select or expand LCD menu items.
REMOTE ENABLE/ DISABLE	Enables or disables remote control of the transmitter. Enable: The transmitter system can be remotely controlled by either the user parallel interface or the remote web interface. Disable: The transmitter will only respond to local commands issued from the various front panel controls.
POWER RAISE/ LOWER	Pressing raise will increase RF power output. Lower decreases power output. *Caution: There may be a slight lag in system power level response time.* Holding buttons in may cause undesired overshoots.

WARNING: Disconnect primary power prior to servicing.

NOTE:
Neither the feature key nor the modulation settings can be changed using the LCD interface. These settings can only be changed with the web browser interface.

3.1.2 LCD Menus

LCD menu trees can be found below in Figures 3-2 Power, 3-3 Status, & 3-4 Setup. Web screens are organized in a similar fashion.

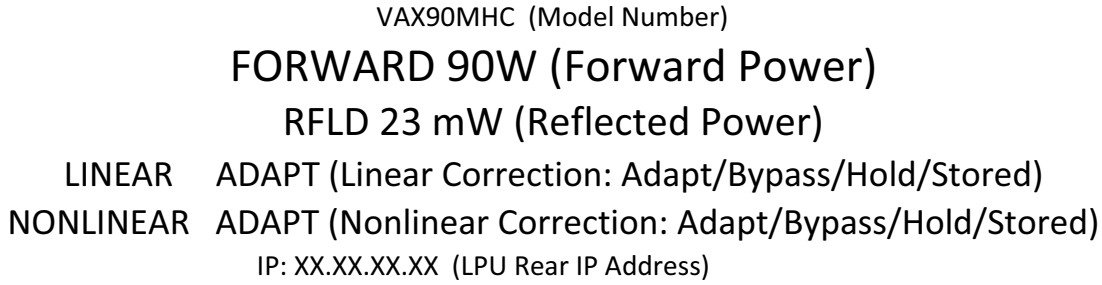

VAX90MHC (Model Number)
FORWARD 90W (Forward Power)
RFLD 23 mW (Reflected Power)
LINEAR ADAPT (Linear Correction: Adapt/Bypass/Hold/Stored)
NONLINEAR ADAPT (Nonlinear Correction: Adapt/Bypass/Hold/Stored)
IP: XX.XX.XX.XX (LPU Rear IP Address)

Figure 3-2 VAX-C LCD Power Menu

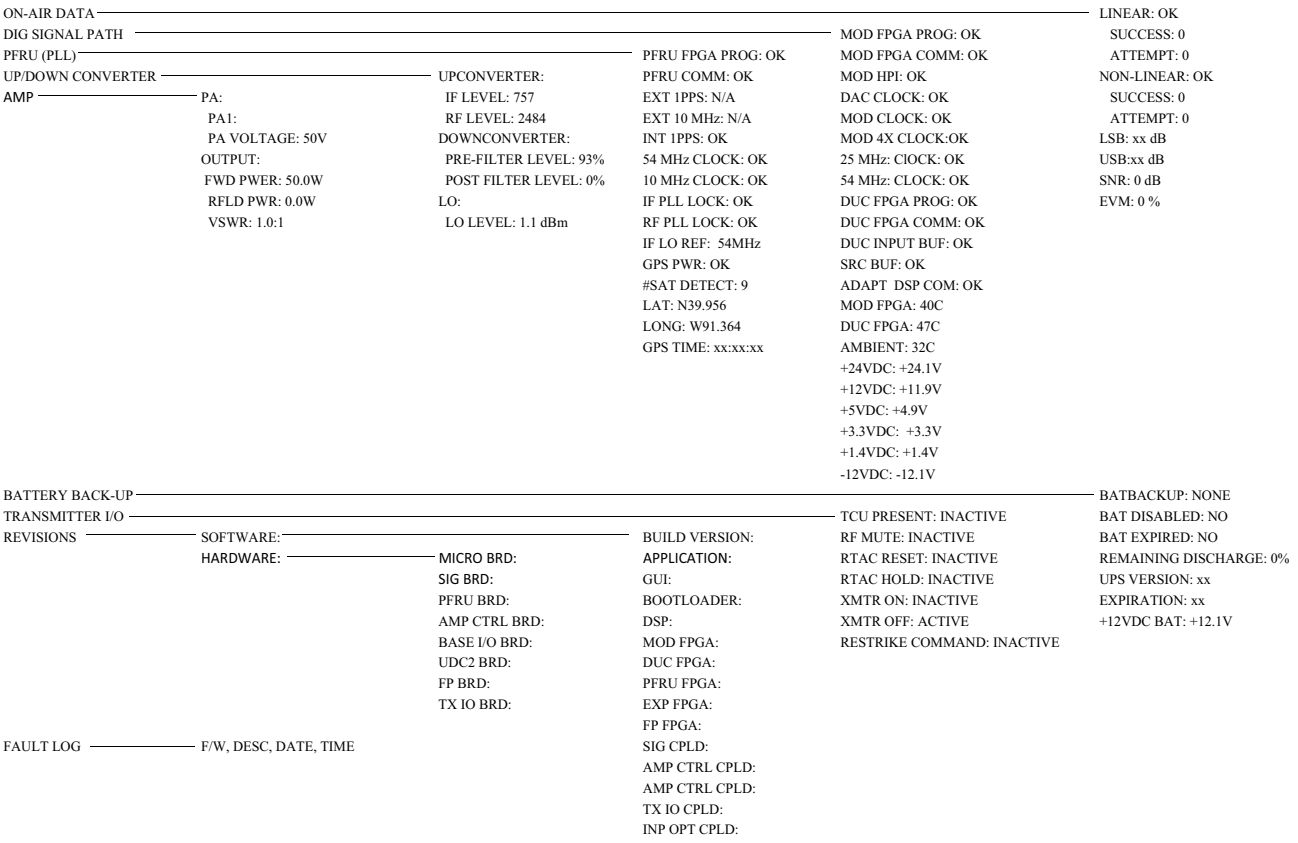


Figure 3-3 VAX-C LCD Status Menu

WARNING: Disconnect primary power prior to servicing.

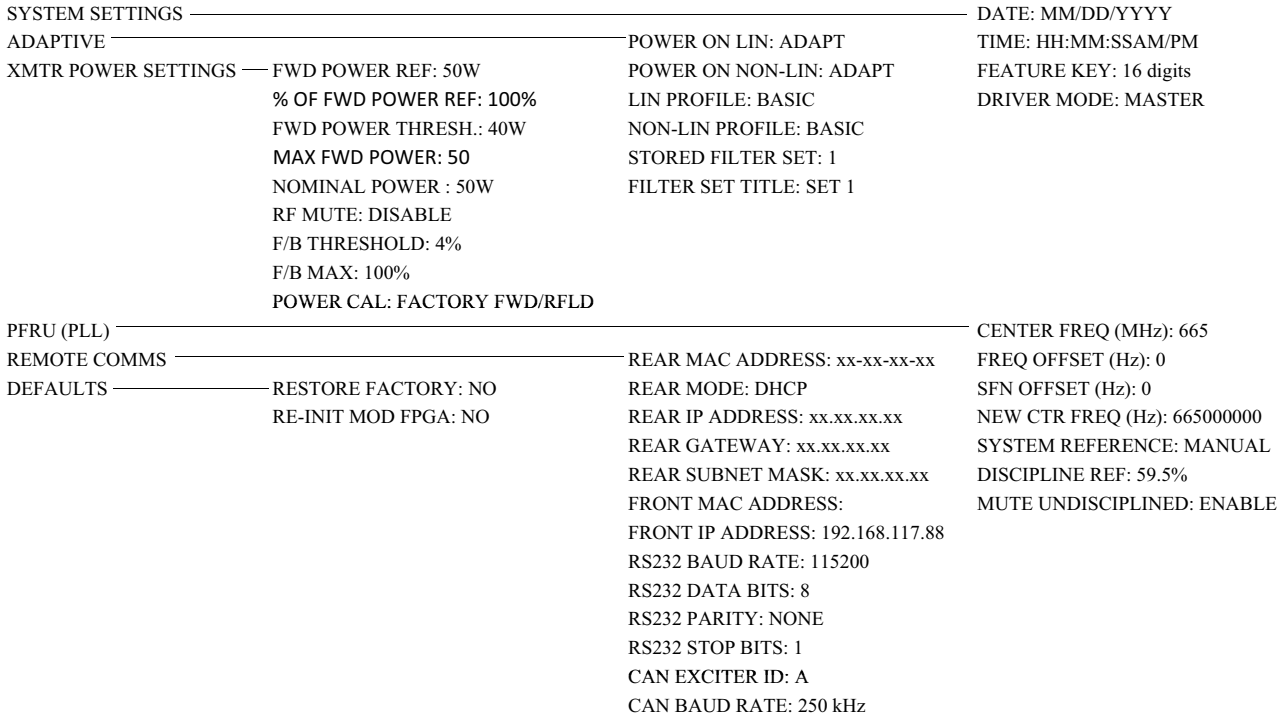


Figure 3-4 VAX-C LCD Setup Menu

WARNING: Disconnect primary power prior to servicing.

3.1.3 Front Panel LEDs

Table 3-2 provides information on the front panel LEDs. Additional information on LEDs and the faults that activate them are given in the fault tables in Section 6.3.

Table 3-2 Status LEDs

Status LEDs	States	Explanation
TS INPUT	Green = OK Amber/Yellow = Warning Red = Fault	Represents the availability of the Transport Stream input data to the Modulator. The behavior of the TS INPUT LED varies with modulation standard.
DRIVE CHAIN	Green = OK Amber/Yellow = Warning Red = Fault	Represents a summary status of the LPU PA Block. i.e. The amplifier section occupying the lower half of the LPU chassis.
POWER AMP	Green = OK Amber/Yellow = Warning Red = Fault Off = N/A	Represents a summary status of the external PA blocks 1-4. If no external PA blocks are present for the current TX model, LED is OFF.
POWER SUPPLY	Green = OK Red = Fault	Represents a summary status of the Signal Processor Power Supplies (+24V, +12V, +5V, +3.3V, +1.4V, -12V).

WARNING: Disconnect primary power prior to servicing.

Table 3-2 Status LEDs

Status LEDs	States	Explanation
OUTPUT	Green = OK Amber/Yellow = Warning Red = Fault	Represents the status of the RF output for the system. When the transmitter is switched off, the OUTPUT LED is either off or green, depending on the factory system setup. Green: The transmitter is switched on, and the RF output level is greater than the FWD POWER THRESH (also called FWD LOW PWR WARNING) setting. Yellow: The transmitter is switched on, but the RF output level is below the FWD POWER THRESH setting. Red: The transmitter is switched on, but the RF output is muted. Note: In a dual system, the OUTPUT LED for the inactive (reserve) LPU will be green if the unit is switched on and not muted. The FWD POWER THRESH threshold check is not applied to the inactive LPU.
SYSTEM	Green = OK Amber/Yellow = Warning Red = Fault	Represents a summary status of the exciter subsystem of the LPU. This includes the Signal Processor (including the Modulator, DUC, RTAC) UDC, Transmitter I/O Board, PFRU, Battery Backup, and MCU.
MUTE	Green = OK Red = Fault	Indicates that the transmitter is switched on, but the RF output is presently muted.

WARNING: Disconnect primary power prior to servicing.

3.2 Xmtr Home Screen

The web browser interface is designed to provide complete control and monitoring of the transmitter. The menu sections are described in this section of the manual. Generally, the information found on the web browser screens can also be found on the LCD menus.

NOTE:
Neither the feature key nor the modulation settings can be changed using the LCD interface. These settings can only be changed with the web browser interface.

NOTE:
If remote control is disabled, navigation and monitoring using the web browser is still possible, but transmitter control is not.With remote control enabled, navigation and control is accomplished via HTML web browser interface screens.

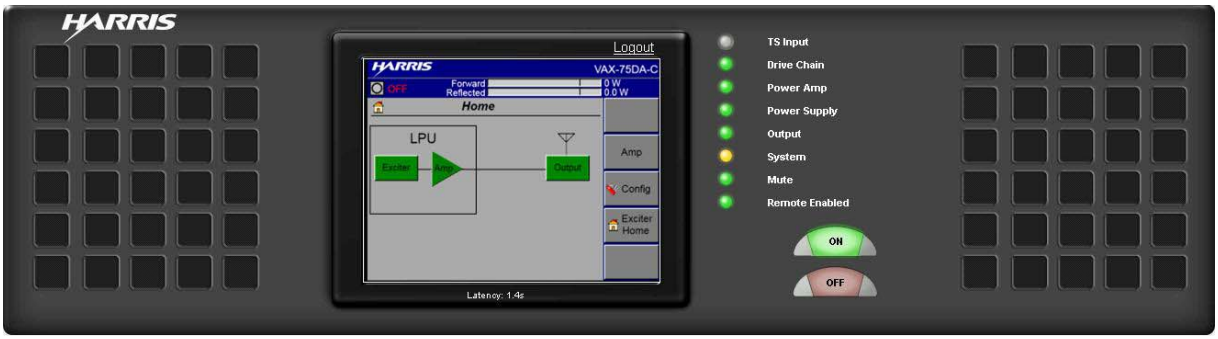


Figure 3-5 VAX-C Front Panel

Upon initial logon via a web browser, the full VAX-C front panel (see Figure 3-5) is displayed. Status indicators displayed are: TS Input, Drive Chain, Power Amp, Power Supply, Output, System, Mute, Remote Enabled. Colors indicate status: Green = OK. Amber = Warning. Red = Error. ON and OFF soft keys are provided.

Using the recommended Firefox browser, increase the display size by pressing <ctrl> and <+>. Buttons and areas that are selectable are indicated by a ’hand’ pointer on mouse over.

The term ’Xmtr Home’ refers to the top level transmitter GUI (graphical user interface) screen.

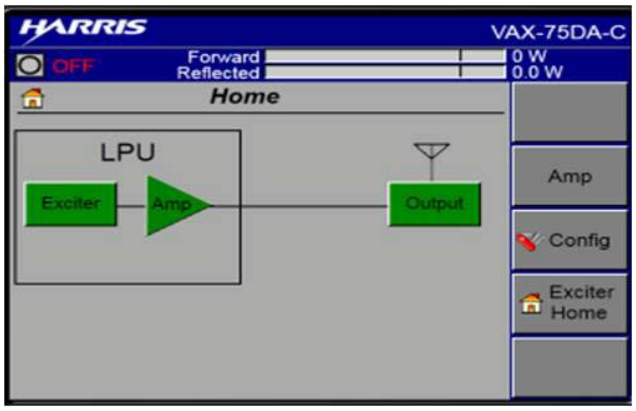
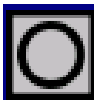


Figure 3-6 Xmtr Home Screen

Table 3-3 Xmtr Home Screen

Window	Description
LPU Sub Window	
Exciter	Displays the Exciter Home screen which is the access point for exciter settings, status and fault log screens.
Drv	Displays the LPU Driver and PA screen which gives amplifier FET current, temperature and voltage.
Output	Displays the Output information screen which displays forward power, reflected power and VSWR levels.
Softkeys	
LPU PAs	Displays the LPU Driver and PA screen which gives amplifier FET current, temperature and voltage.
Config	Displays System Configuration pages which allow set up of power level, foldback thresholds and warnings.
Exciter Home	Displays the Exciter Home screen which is the access point for exciter settings, status and fault log screens.

Each VAX-C web browser screen has a transmitter ON/OFF status icon at the upper left as shown in Figure 3-6.

represents **ON**, and  represents **OFF.**

To the right of the **ON/OFF** icon, 'ON', 'OFF', 'TEST', or 'MUTE' will be displayed. The forward and reflected power bars are always visible at the top of each screen.

WARNING: Disconnect primary power prior to servicing.

3.2.1 Output Screen

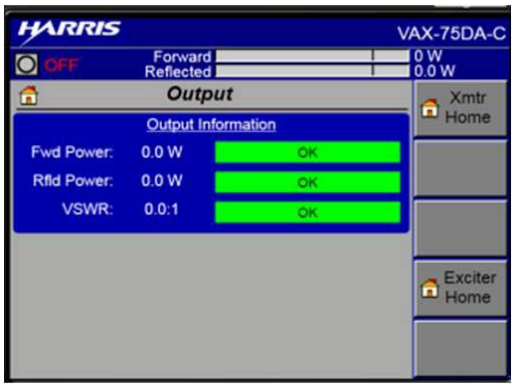


Figure 3-7 Output Screen

Table 3-4 Xmtr Home>Output

Field	Explanation
Output Information Sub Window	
Fwd Power	Output of transmitter in W.
Rfld Power	Reflected power in W.
VSWR	Voltage standing wave ratio.
Softkeys	
Xmtr Home	Displays the Xmtr Home screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.2.2 Amplifier Screen

The Amplifier screen can be accessed from the Xmtr Home page by pressing either the Amp button on right or Amp icon in the LPU sub window. It contains amplifier status and operational information.

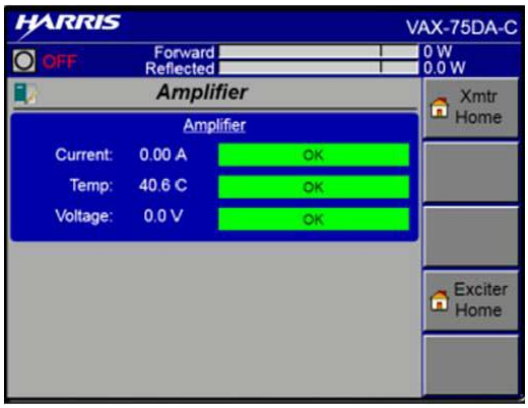


Figure 3-8 Amplifier Screen

Table 3-5 Xmtr Home>LPU PAs

Window	Description
Amplifier Sub Window	
Current	Displays the FET drain current in amps. Fault levels are 2 A for 75/50/90 W amp or 11 A for 150/100/180 W amp.
Temp	Displays the power amplifier board temperature level in degrees C. Fault level is >85 C^o. Clears when temp is <75^0 C
Voltage	38 to 52 V nominal. Faults at <32 and >54 Vdc.
Softkeys	
Xmtr Home	Displays the Xmtr Home screen.
Exciter Home	Displays the Exciter Home screen which is the access point for exciter settings, status and fault log screens.

WARNING: Disconnect primary power prior to servicing.

3.2.3 Configuration Screens

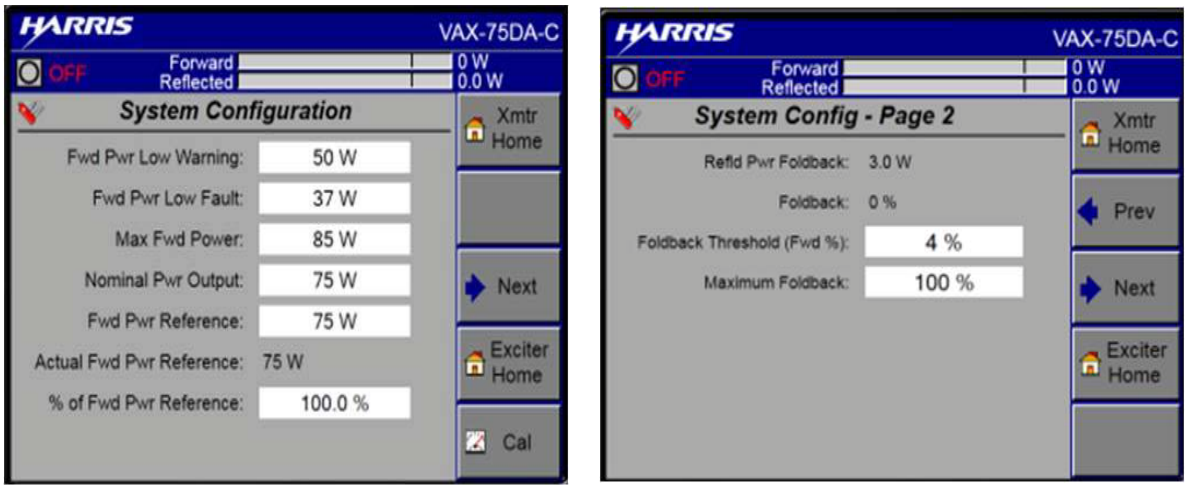


Figure 3-9 System Configuration Screens 1 & 2

Table 3-6 Xmtr Home>Config

Field	Explanation
Fwd Low Pwr Warning	Set the minimum forward power in watts (W) below which a warning is indicated. If the transmitter output power drops below this level, the forward power bar and Output LED will turn yellow. This value must be lower than Nominal power.
Fwd Low Pwr Alarm	Set the minimum forward power in watts (W) below which a fault is indicated. If the transmitter output power drops below this level, the forward power bar and Output LED will turn red. This value must be lower or equal to the FWD Low PWR Warning.
Max Fwd Power	Set the maximum forward power in watts (W) above which a fault is indicated. If the transmitter output power exceeds this level, the forward power bar will turn Red. This value must be larger than the Nominal Power Output.
Nominal Power Output	This entry sets the maximum level that the Fwd Power Reference can be set to in watts (W), and also sets the 100% forward power bar level.
Actual Fwd Power Ref	This field represents the actual power setting in the transmitter. The actual power setting can be reduced from the Fwd Power Reference setting due to any of the following reasons: - The value of the % of Fwd Pwr Reference setting is less than 100%. - Faulted PA components have reduced the maximum output power of the system below the Fwd Pwr Reference setting. - Transmitter is in power foldback state due to a high level of reflected power at the transmitter output.

WARNING: Disconnect primary power prior to servicing.

Table 3-6 Xmtr Home>Config

Field	Explanation
% of Fwd Pwr Reference	Set the percentage of actual transmitter output power. (Valid range 0 - 100%) If the Fwd Power Reference = 1000W, and the % of Fwd Pwr Reference = 75%, then the actual forward power reference will be 750W.
Fwd Power Reference	Set the desired forward power of the transmitter in watts (W). The Fwd Power Reference setting is limited by the Nominal Power Output setting, thus the valid range for this control is 0 - Nominal Power Output (W).
Reflected Power F/B	This is the level of reflected power in watts (W) that if exceeded will activate power foldback. (This is a status only field).
Foldback	Percentage that System Output Power is currently being folded back due to presence of high reflected power conditions.
Foldback Threshold (Fwd %)	This level represents the percentage of reflected power that can be tolerated before initiating foldback. The level can be set from 1 to 4%. Four percent is the maximum reflected power setting allowed (approximately 1.5:1 VSWR). A reflected power level of 1% corresponds to a 1.22:1 VSWR. A system foldback threshold setting of 4% means that reflected levels greater than 4% would initiate a foldback of transmitter output power.
Maximum Foldback:	This is the maximum amount of foldback allowed. Maximum Foldback can be set between 50 and 100%. Power foldback occurs when the Foldback Threshold, described above, is reached or surpassed. Foldback allows the transmitter power amplifier(s) to operate at a safe (reduced) output power level when high VSWR conditions occur. A 100% foldback level means the power out of the transmitter would be zero. A 50% foldback level would reduce the transmitter output power to half power.
Foldback Release TC (s):	This is the amount of time, in seconds, that the control system waits after foldback is activated before attempting an output power increase step. The range is 5-120 seconds.
Softkeys	
Xmtr Home	Displays the Xmtr Home screen.
Cal	Displays calibration screen as shown in Figure 3-10.
Exciter Home	Displays the Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.2.4 System Calibration Screens

Refer to 'System Calibration' screen shown in Figure 3-10. The Calibration screens walks the user through the calibration procedure.

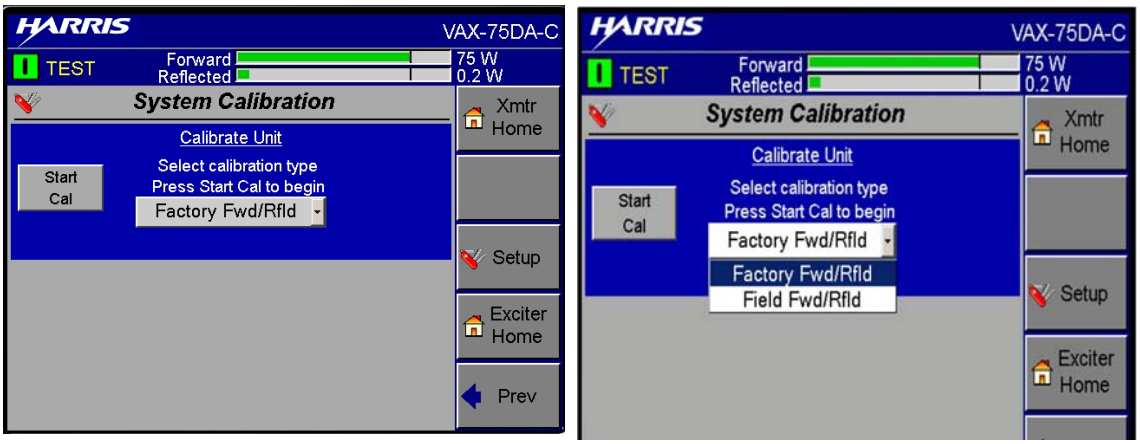


Figure 3-10 System Calibration Screen & Menu

Table 3-7 Xmtr Home>Config>Cal

Field	Explanation
Factory Fwd/Rfld	Factory Fwd/Rfld calibrates the system forward and reflected power meter. Factory calibration is used as a reference calibration across the VHF band. The factory forward calibration is performed at 205 MHz (center of VHF band). This is a two point calibration process that saves calibration points at a low calibration point (approximately 10dB down from the transmitter model power) and a high calibration point (transmitter model power).
Field Fwd/ Rfld	The Field Fwd/Rfld calibration is used as an additional correction to the factory calibrations. This is useful when the factory forward calibration is being used as a reference calibration, and the user wants to "touch up" the system forward power meter upon a change in frequency or permanent power level (e.g. upon installation if licensed TPO is significantly less than transmitter nameplate power rating). The field calibration process is a one point calibration (at the current FWD POWER REFERENCE setting). This also allows the user to perform the field calibration without changing the current output power level of the transmitter.
Start Cal	The Start Cal soft button turns Green to indicate that calibration is active, and the adjust output power window appears to walk the user through the low and high calibration points. System Calibration is discussed in depth in Section 5.4 "Power Calibrations". Refer to that section for the complete procedure

WARNING: Disconnect primary power prior to servicing.

Table 3-7 Xmtr Home>Config>Cal

Field	Explanation
Cal Complete	Once the user has completed all desired calibrations, the Cal Complete button MUST be pressed to return the system to previous mode of operations.This will allow the system to resume Auto power control mode. If the user does not press the Cal Complete button the system will remain in Manual power control mode until navigating away from the Cal screen.
Softkeys	
Xmtr Home	Displays the Xmtr Home screen.
Setup	Pressing this soft key displays the Main 'Setup' Screen in Figure 3-14 on page 3-21. This screen accesses the various setup screens for the transmitter. See Section "3.4 SETUP SCREENS, All Modulation Systems" on page 3-21
Exciter Home	Displays Exciter Home screen.

NOTE:
The Transmitter must be ON prior to beginning any calibration.

When calibration is in process, the screen in Figure 3-11 will appear to allow adjustments of the output power.

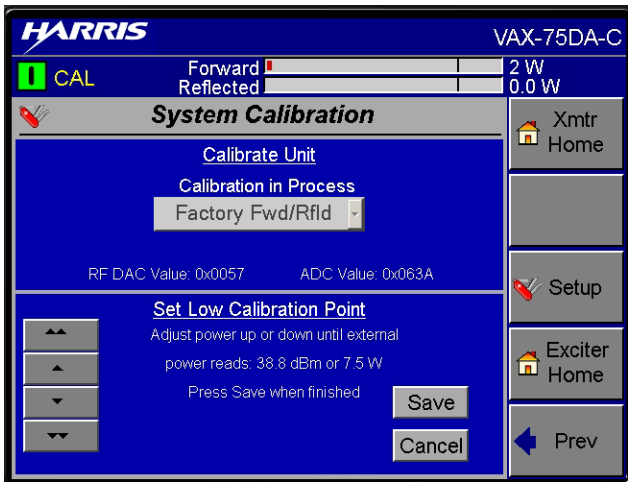


Figure 3-11 Home>Config>System Calibration Screen

The arrows on the left of the screen directly adjust the UDC RF attenuator DAC. (RF DAC value displayed in top window) The single arrows will increase or decrease the

hex value by 0x0001 (1 decimal) increments. The double arrows will increase or decrease the RF DAC hex value by 0x0010 increments (32 decimal).

Due to the delayed update rate of the web browser, the user should not rely on the RF DAC Value displayed on the GUI to determine if power is being raised real time, as this can cause undesired overshoots. Instead the user is advised to monitor their power meter at all times while adjusting the output power.

The ADC value displayed represents the ADC detector reading corresponding to the calibration type selected. (if calibration type = Factory Forward, the ADC value will display the system forward power detector.)

Once the correct power is displayed on the external power meter, pressing the Save button will advance the process to the next calibration point, or will complete the calibration process. To cancel the calibration process without saving any data, select Cancel.

NOTE:
Calibration can abort automatically if a fault condition is detected during the calibration process. If this occurs, an error message will be displayed to the user. Calibration error conditions are outlined in Table 3-8.

System Calibration is discussed in depth in Section 5.4, Power Calibrations, on page 5-10. Refer to that section for the complete system power calibration procedure.

Table 3-8 Calibration Faults

Fault	Explanation
PA Fault Detected	There is a PA fault that is currently limiting the maximum available output power of the transmitter. The fault condition must be cleared before calibration can continue.
Invalid Detector Values:	The low and high point ADC values saved are invalid. The ADC values are considered valid if the following checks are met: - Both Low and High point ADC values are between 0x000 to 0xFFF - High point ADC value > Low Point ADC value - High point ADC value – Low Point ADC value >= 50
Exciter RF Output Level Fault	The UDC RF Output power level is at or above the UDC Output Power Limit setting. The fault condition must be cleared before calibration can continue.
Transmitter OFF	The transmitter must be turned ON before calibration can continue.

3.3 Exciter Home Screen

Refer to Figure 3-12 on page 3-17 Exciter Home Screen. This screen gives access to the basic command inputs, status outputs, output indications and chart graphics necessary for the day-to-day operation of the VAX-C exciter section. Descriptions of the various home screen sections are given in the following table.

The on air performance data comes from the post mask filter sample, and is not switchable.

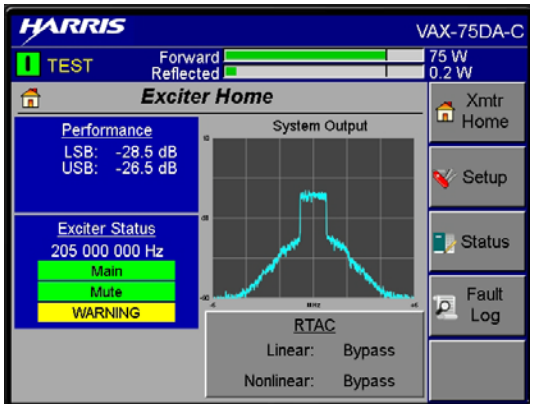


Figure 3-12 Exciter Home Screen

Table 3-9 Exciter Home Screen

Window	Description
Performance Sub Window	
LSB	Lower sideband intermodulation product level, in dB, at the shoulder (first 0.25MHz into the lower adjacent channel) after the filter.
USB	Upper SideBand intermodulation product level, in dB, at the shoulder (first 0.25MHz into the Upper adjacent channel) after the post HPF.
SNR	Signal to noise ratio in dB (ATSC only, not shown in figure).
EVM	Error vector magnitude in % (ATSC only, not shown in figure).
Exciter Status Sub Window	
205 000 000 Hz	Transmitter frequency in Hertz.

WARNING: Disconnect primary power prior to servicing.

Table 3-9 Exciter Home Screen

Window	Description
Main/Standby	This field indicates the on-air status. In a dual drive system, an active transmitter will display Main (green field). The inactive exciter will display Standby (in blue).
Mute/MUTE	This field indicates the mute status of the exciter section. If RF output is muted, this field displays MUTE (uppercase, red field). If the output is not muted, the field displays Mute (lowercase, green field). When the transmitter is switched OFF, the MUTE field will be red.
OK/WARNING/ FAULT	This field indicates a summary status of the exciter section. If no warnings or faults exist within the exciter section, the indication displays OK (green field). When an exciter parameter approaches its limit, the fields displays WARNING (yellow field). If a fault occurs within the exciter, the field displays FAULT (red field).
RTAC Window The RTAC (Real Time Adaptive Correction) section of the Exciter Home Screen displays the operating mode of the correctors. The RTAC section of the Exciter Home screen is a soft key. When selected by left mouse click, the first screen of RTAC Setup is presented.	
Linear	Corrector uses RF feedback sample taken after the high power filter. Used to correct for filter distortions in amplitude and group delay. See Figure 2-5 on page 2-17.
Nonlinear	Corrector uses RF feedback sample taken before the high power filter. Used to correct for linearity and incidental phase distortion in the high power amplification stages.
Linear and Nonlinear Modes	Adapt: The correction algorithm is active and will continuously calculate and update correction as needed. Hold: The RTAC circuit keeps the last correction value for the selected mode. This is a short term option. For long term use select Stored. Stored: The RTAC circuit preloads a stored correction algorithm from one of the stored Correction Sets. This represents a long term storage method. Bypass: Turns the selected corrector off.
System Output Sub Window	
Graph	Displays the spectrum response of the signal that is connected to the transmitter post filter input on the back of the unit. See Figure 2-5 on page 2-17 for connection location.
Softkeys	
Xmtr Home	Displays the Xmtr Home screen.
Setup	Pressing this soft key displays the Main 'Setup' Screen in Figure 3-14 on page 3-21. This screen accesses the various setup screens for the transmitter. See Section "3.4 SETUP SCREENS, All Modulation Systems" on page 3-21.
Status	Pressing this soft key displays the Main 'Status' Screen in Figure 3-51 on page 3-81. This screen accesses the various Status screens for the transmitter.

WARNING: Disconnect primary power prior to servicing.

NOTE:

The LSB, USB, and in band intermodulation products are caused mainly by the transmitter's non-linear distortions due to poor power amplifier linearity and phase distortion. They are mainly developed in the PA stage. If the amplifier is substantially linear, the shoulders will be -36 dB or lower. As the non-linear distortions increase, the shoulder levels will rise above -36 dB. Unequal USB and LSB shoulder levels indicate the presence of phase distortion.

3.3.1 Fault Log screens

Refer to Fault Log -All Faults screen Figure 3-13 on page 3-20. Active warnings are displayed in yellow, active faults are displayed in red. Select Next Page soft keys to view additional Fault Log pages.

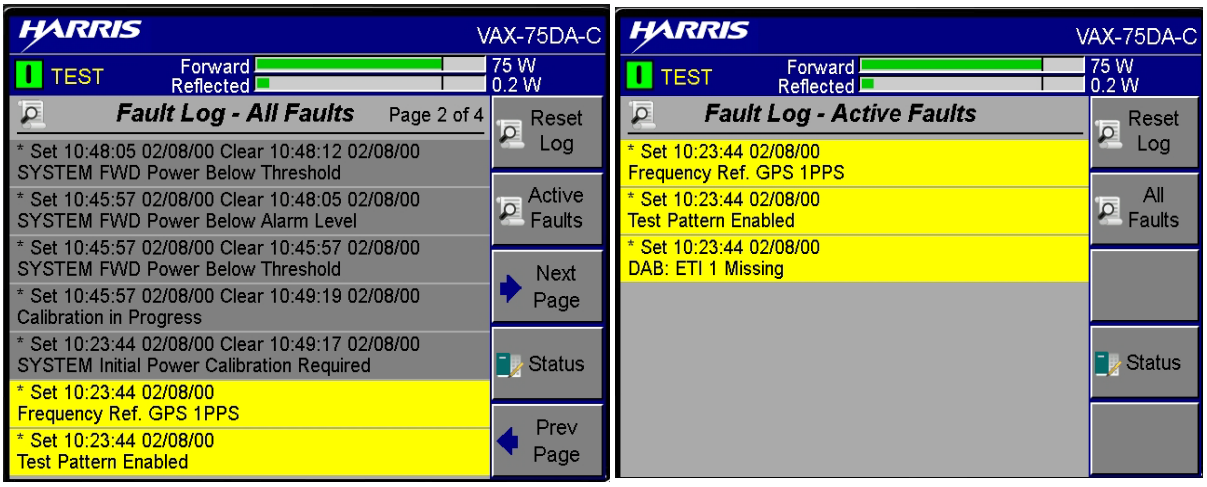


Figure 3-13 Fault Log - All Faults (left) & Active Faults Screens (right)

Table 3-10 Xmtr Home>Exciter Home Screen

Window	Description
Softkeys	
Reset Log	Permanently clears inactive faults and warnings from the display.
Active Faults	Displays active faults only. Refer to Active Faults screen Figure 3-13.
Next Page	Pressing this soft key displays the Main 'Status' Screen in Figure 3-51 on page 3-81. This screen accesses the various Status screens for the transmitter.
Status	Displays Status screen.
All Faults	Displays all faults. Refer to All Faults screen Figure 3-13.

WARNING: Disconnect primary power prior to servicing.

3.4 SETUP SCREENS, All Modulation Systems

From the 'Xmtr Home' Screen Figure 3-6 on page 3-9 select the 'Exciter Home' soft key and then select 'Setup'. Setup subscreens are accessed from this Main Setup Screen.

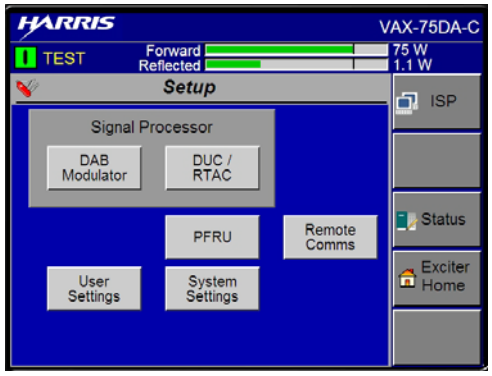


Figure 3-14 Setup Screen

Table 3-11 Xmtr Home>Exciter Home>Setup

Field	Explanation
User Settings	See 3.4.7, on page -37.
Transmitter I/O	Only available for select modulations. See Figure 3-18 on page 3-31.
PFRU	See 3.4.5 on page 3-33.
UDC/ Output	See 3.11.2, on page -84.
Remote Communications	See 3.4.6, on page -35.
Signal Processor	See 3.11.1, on page -82.
System Settings	See 3.4.8, on page -39.
Softkeys	
ISP	Pressing this soft key displays the ISP 'In-System Programming' Screen shown in Figure 3-15 on page 3-22. The ISP screen is used to load software into the transmitter.
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.4.1 ISP (In-System Programming) Screen

See "5.2 PA Module Removal and Replacement" on page 5-2 for information regarding updating software.

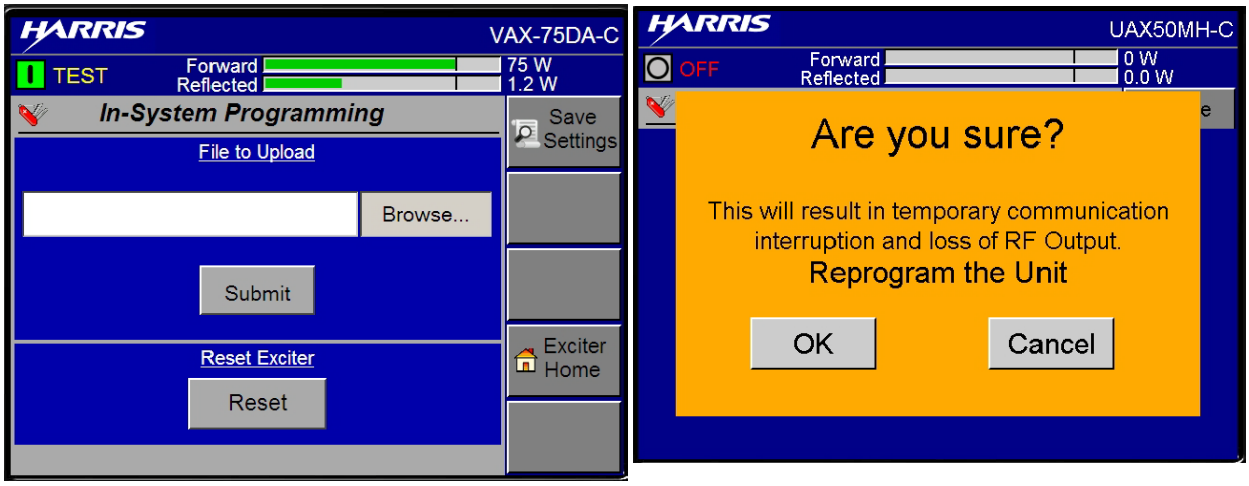


Figure 3-15 Xmtr Home>Exciter Home>Setup>ISP

Table 3-12 Xmtr Home>Exciter Home>Setup>ISP

Fields	Explanation
File to Upload	Enter name and location of file containing latest software. Filename ending in .s19 must be entered. Settings files can also be entered here.
Browse	Press button to locate file to upload.
Submit	Uploads file to transmitter.
Reset	Reboots software in exciter section after confirmation and takes transmitter off-air for a few seconds during reboot. Press reset after changing feature key to activate new features. Communication will be lost during the reboot and login will be required after the reboot is completed.
Are You Sure	Press OK to load new software onto microprocessor.
Softkeys	
Save Settings	Opens a screen that contains coded settings. Settings can be stored to computer or thumb drive for later restorations.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

CAUTION:
TRANSMITTER WILL BE OFF-AIR DURING RESET OR PROGRAMMING FORCED REBOOT.

3.4.1.1 Save Settings Soft Key

Selecting the Save Settings soft key on the ISP screen saves a copy of the current user settings stored in EEPROM. See additional instructions for saving and restoring VAX-C settings in "5.13.1 Saving and Recalling Settings" on page 5-46.

3.4.2 RTAC Setup Screens 1 & 2

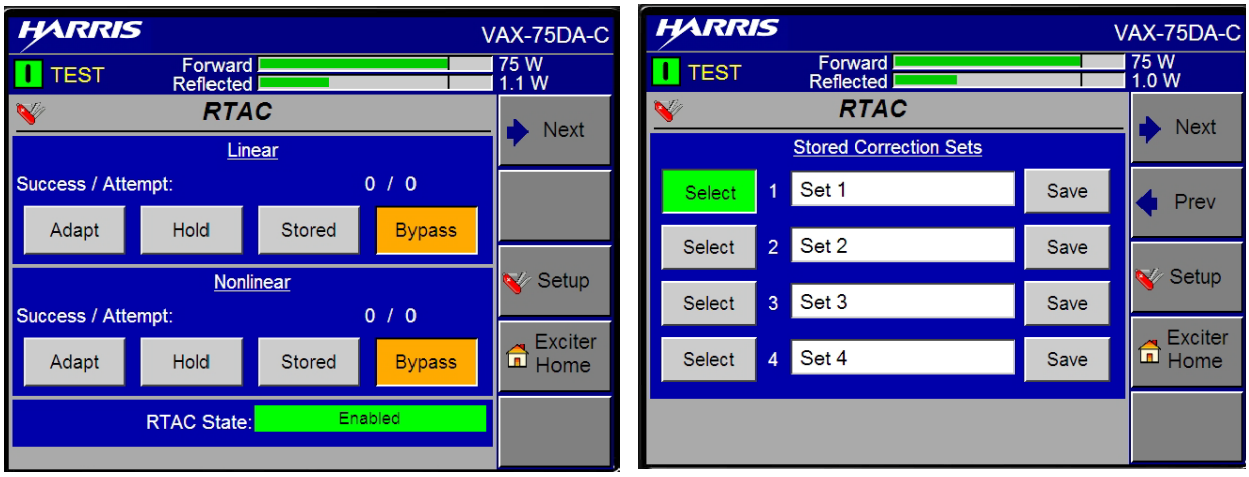


Figure 3-16 RTAC Setup Screens 1 & 2

Table 3-13 Xmtr Home>Exciter Home>Setup>DUC/RTAC

Field	Explanation
Linear: RF feedback sample is taken after high power filter.	
Success/Attempt x/x	The digit to the right of the / indicates the number of times that corrector attempted to make a correction. The digit to the left of the / indicates the number of times the corrector succeeded in making a correction. Just because the number of attempts does not equal the number of success does not mean that RTAC is not functioning.
Adapt	Pressing the Adapt soft key turns it green and turns the selected corrector on. The correction algorithm will continuously calculate and update correction as needed. When switching to this mode from any other mode, the correction algorithm is reset. Which will also reset the number of success and attempts.The normal operational mode is Adapt.
Hold	Pressing the Hold soft key turns it green and keeps the last correction value for the selected mode. This is a short term option. For long term use select Stored. With HOLD active correction is engaged but not adapting to any new solution for changes in the amplifiers or filters.
Stored	Pressing the Stored soft key turns it green and selects a previously stored set of corrections which are used as a static digital precorrection. The corrections are saved by using the Stored Correction Sets sub window in the RTAC Page 2 screen *on right* Figure 3-16 on page 3-24 and at Section 3.4.2.1. Storing the current active RTAC filter setup or *operating from a previously stored setup* is covered in Section 3.4.2.1.

WARNING: Disconnect primary power prior to servicing.

Table 3-13 Xmtr Home>Exciter Home>Setup>DUC/RTAC

Field	Explanation
Bypass	Pressing the Bypass soft key turns it orange. Selecting Bypass turns the selected corrector OFF. Correction is not engaged.
Nonlinear: RF feedback sample is taken before the high power filter.	
Success/Attempt x/x	The digit to the right of the / indicates the number of times that corrector attempted to make a correction. The digit to the left of the / indicates the number of times the corrector succeeded in making a correction. Just because the number of attempts does not equal the number of success does not mean that RTAC is not functioning.
Adapt	Pressing the Adapt soft key turns it green and turns the selected corrector on. The correction algorithm will continuously calculate and update correction as needed. When switching to this mode from any other mode, the correction algorithm is reset. Which will also reset the number of success and attempts. The normal operational mode is Adapt.
Hold	Pressing the Hold soft key turns it green and keeps the last correction value for the selected mode. This is a short term option. For long term use select Stored. With HOLD active correction is engaged but not adapting to any new solution for changes in the amplifiers or filters.
Stored	Pressing the Stored soft key turns it green and selects a previously stored set of corrections which are used as a static digital precorrection. The corrections are saved by using the Stored Correction Sets sub window in the RTAC Page 2 screen *on right* Figure 3-16 on page 3-24 and at Section 3.4.2.1. Storing the current active RTAC filter setup or *operating from a previously stored setup* is covered in Section 3.4.2.1.
Bypass	Pressing the Bypass soft key turns it orange. Selecting Bypass turns the selected corrector OFF. Correction is not engaged.
RTAC State	Enabled = Green. Disabled = Red. If the RTAC status is Disabled, this indicates that RTAC will not adapt. The RTAC can be disabled due to any of the following reasons: - Power is in Manual control mode - Power Calibration is active - Transmitter is in Off state - External Hold command is asserted - Transmitter was turned on but output power failed to ramp up to ACTUAL
Stored Correction Sets	Select Set 1-4. Save Set 1-4. This screen provides a choice of locations for storing four different RTAC settings.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.4.2.1 Storing an RTAC Correction Set

From the Stored Correction Sets sub window, up to four RTAC correction setups can be saved in Set 1 through Set 4. There is an option to rename each stored setup. The setup can be stored for many reasons, such as when the transmitter was first installed, or after transmitter maintenance. This feature is also useful in comparative testing.

Follow the procedure below to save an RTAC Correction setup.

STEP 1 The transmitter should be operating properly at 100% power.

STEP 2 Refer to RTAC Setup Page 1 *on left* Figure 3-16 on page 3-24. Set the Linear and Nonlinear RTAC corrections to Adapt.

STEP 3 After a short time, the number of successes and attempts will increment above the RTAC Linear and Nonlinear Bypass selection soft keys. Both the Linear and Nonlinear correctors should show one or more successful corrections. Verify that the measured performance of the signal is adequate using appropriate test equipment. LSB and USB shoulders are found in the Exciter Home Performance sub window Figure 3-12 on page 3-17. These parameters are discussed in Table 3-9 on page 3-17, Performance sub window.

STEP 4 After the RTAC adaption has been successful, press the RTAC Linear and Nonlinear Hold soft keys to hold the adaptive process steady.

STEP 5 By selecting Next soft key, go to RTAC Setup Page 2. Select a correction set. The title of the selected set may be changed by clicking in the white box of the desired set. Press ‘Save’ to store the RTAC setup.

3.4.2.2 Operate RTAC from a Stored Filter Set

To operate RTAC from a Stored set, follow the procedure below.

STEP 1 In the Stored Correction Sets sub window of the RTAC Setup Screen 2 (*on right* Figure 3-16 on page 3-24) press the Select soft key to the left of the desired correction set. The Select button will turn Green. Select Prev soft key to return to RTAC Page 1.

STEP 2 On the RTAC Setup Page 1 (*on left* Figure 3-16 on page 3-24) set Linear and Nonlinear to Stored for operation with the selected stored set.

3.4.3 DUC/RTAC Setup Screen 3 & 4

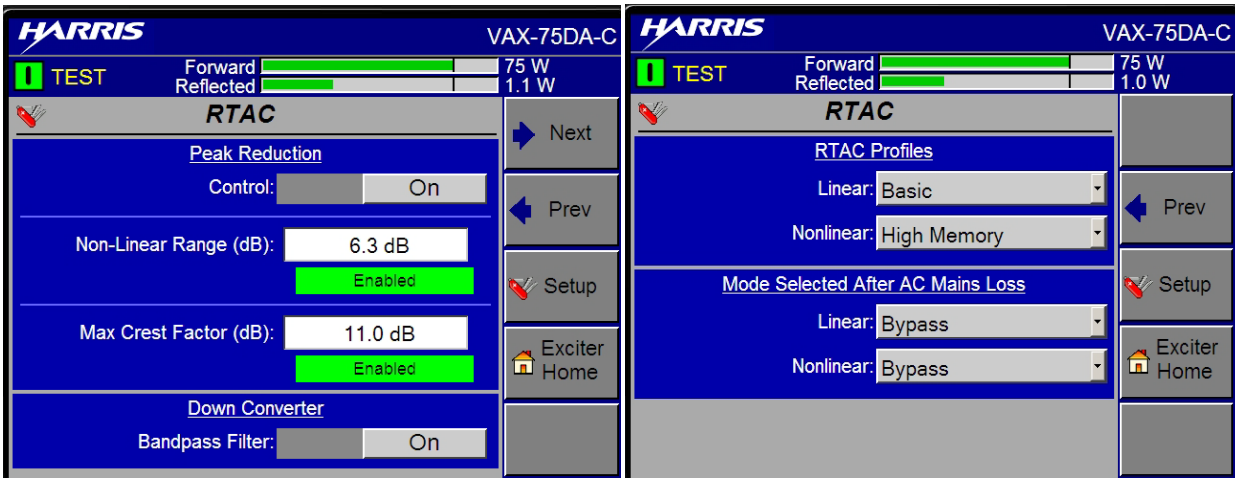


Figure 3-17 RTAC Setup Screens 3 & 4

Table 3-14 Xmtr Home>Exciter Home>Setup>DUC/RTAC>Next & >Next

Field	Explanation
Peak Reduction	
Peak Reduction limits the RF peak power output of the transmitter to provide optimum RTAC performance, while preventing nuisance transmitter PA overdrive trips. In most cases, default settings should be used.	
Non-Linear Range (dB)	Green if Enabled. Set in dB. Default values are typically used: ATSC = 7dB OFDM = 8dB DAB = 6 dB
Max Crest Factor (dB)	Max Crest Factor (dB): Set in dB. Default values are typically used: ATSC = 11dB OFDM =13dB DAB = 10 dB
Downconverter	
Bandpass Filter	On/Off: The IF bandpass filter in the RF down converter filters out mixing products from the down conversion. This filter has a slight frequency response irregularity which affects the linear correction. For VHF channels with no adjacent channels on the post-filter feedback, this filter can be off. Otherwise this filter must be on.

WARNING: Disconnect primary power prior to servicing.

Table 3-14 Xmtr Home>Exciter Home>Setup>DUC/RTAC>Next & >Next

Field	Explanation
RTAC Profiles: Profiles are used to tune the RTAC for various linear and nonlinear operating conditions. Profile choices for linear and non-linear correction are available. The correct profile will improve RTAC performance.	
Linear	Drop menu and select: Basic, Short, Long, Max, Basic Offset, Short Offset, Long Offset, Max Offset.
Nonlinear	Drop menu and select: Basic, Basic Memory, Profile3, Profile 4, High, High Memory, Profile 7, Profile 8, Profile 9.
Mode Selected after AC Mains Loss	
Linear	Linear: Drop menu and select: Bypass, Adapt, Stored
Nonlinear	Nonlinear: Drop menu and select: Bypass, Adapt, Stored
RTAC Operating Modes During Power Up: When the VAX-C is powered down, RTAC correction for the Adapt and Hold modes is lost, but the stored RTAC corrections are not lost. At power up, the transmitter must operate uncorrected for a few minutes while RTAC adapts. If RTAC power on mode is set to Stored, and if an appropriate correction setup has been previously stored in memory, the Stored correction will be loaded into the RTAC Adapt and Hold circuits. This correction will then become available for the LPU RTAC off air Hold mode or for the Adapt mode if the unit is on the air.	
Power On Linear Mode	The RTAC Power On Linear Mode selection gives the option of having the exciter's linear RTAC correction in the Adapt, Stored, or Bypass mode when the exciter is powered on. In the Stored mode, RTAC settings are obtained from previously stored values from one of the filter sets in the Stored Correction Sets sub window.
Power On Nonlinear Mode:	The RTAC Power On Nonlinear Mode selection gives the option of having the exciter's nonlinear RTAC correction in the Adapt, Stored, or Bypass mode when the exciter is powered on. In the Stored mode, RTAC settings are obtained from previously stored values from one of the filter sets in the Stored Correction Sets sub window.
Frequency Response Tilt	Enter value in dB.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

3.4.3.1 Nonlinear Correction Range Setup

The modulator occasionally generates peaks as high as 18 dB above the average output level. The signal peak power above the average signal power level can be limited at the modulator output by proper setting of the Nonlinear (Correction) Range. Since this limitation takes place before the RTAC correction circuitry, only the range of magnitude

up to this limit will be linearized by nonlinear RTAC correction. The peak power out of the exciter must be limited to protect the following amplifier stages.

NOTE:
If this limit is too low, in-band and out-of-band intermodulation products will increase due to the signal clipping. If the limit is too high, the RTAC nonlinear corrector performance may be degraded due to high peak stretch. Also high peaks could cause nuisance overdrive faults in some transmitter systems.

STEP 1 In the 'RTAC' Setup Screen 1 (*on left* Figure 3-16 on page 3-24) set RTAC Linear and Non-Linear functions to 'Bypass'.

STEP 2 The RF output should be set to the level required for transmitter operation.

STEP 3 In the RTAC 'Peak Reduction' sub window of RTAC Setup Screen 3 (*on left* Figure 3-17 on page 3-27) verify that the Non-Linear Range and Max Crest Factor indicators display 'Enabled'.

STEP 4 In the RTAC 'Peak Reduction' sub window start with the Non-Linear Range at the default value. See Table 3-14 on page 27.

STEP 5 With Both RTAC correctors bypassed, the exciter RF output adjacent channel noise should be 50dB to 55dB below the in band signal level.

As the Nonlinear (Correction) Range value is reduced, the first sign of adjacent channel intermodulation product increase will be very subtle, with the first sign often being increased noise in the area just outside the in-band channel bandpass

3.4.3.2 Max Crest Factor Setup

The Max (Maximum) Crest Factor setting limits the peak to average RF output power ratio (7.8 to 13.0 dB) at the output of the exciter. This directly limits the transmitter RF output peak to average power ratio. The Crest Factor of the transmitted signal is determined by this setting and by the peak compression of the amplifier system.

- If the limit is set too low, clipping will generate out-of-band intermodulation products in the exciter's output and may affect the performance of the RTAC non-linear correction.
- If set too high, it could allow nuisance overdrive trips in some transmitter models, because the high amplitude peaks could overdrive the PA modules.

Nuisance overdrive trips can be avoided by setting the Max Crest Factor parameter section of the RTAC Peak Reduction sub window in RTAC Setup Screen 3, *on left* Figure 3-17 on page 3-27.

Nuisance overdrive trips will typically occur within 30 minutes to 1 hour after transmitter operation with RTAC is first started. If this happens, perform the following:

STEP 1 This setup is performed with the transmitter operating at full power and RTAC Linear and Non-Linear functions set to Adapt.

STEP 2 Start with the Max Crest Factor at the default value. See Table 3-14 on page 27.

STEP 3 Reduce the Max Crest Factor by 0.2dB.

STEP 4 Wait for one hour to see if further overdrive trips occur. If they do, reduce by another 0.2dB.

STEP 5 Repeat steps 3 & 4 until overdrive trips cease.

STEP 6 Excessive reduction will effect the linearity correction of the transmitter. After Max Crest Factor has been adjusted, observe the adjacent channel response to ensure that it still exceeds the transmitter output signal mask requirements.

3.4.3.3 RTAC Profiles sub window

Profile Linear: For linear RTAC correction, BASIC and LONG OFFSET profiles should be tried first. The rule of thumb here is that more is not necessarily better, so use the first profile that works well. The equalizer length in time generally increases down the list. Linear profile choices are:

- BASIC This correction should be used for most standard mask filters.
- SHORT
- LONG
- MAX
- BASIC OFFSET
- SHORT OFFSET
- LONG OFFSET This correction should be used for sharp tuned mask filters, special mask filters, or when a two or more transmitters of different frequencies are being combined into a single output through 2 or more sharp tuned filters.

WARNING: Disconnect primary power prior to servicing.

- MAX OFFSET

Profile Nonlinear: For non-linear RTAC correction, the named profiles should be tried before the numbered profiles. Most transmitters should use BASIC or BASIC MEMORY. However, if they do not give satisfactory adjacent channel inter-modulation performance, a higher profile such as HIGH or HIGH MEMORY should be used. Nonlinear profile choices are:

- BASIC
- BASIC MEMORY
- PROFILE 3
- PROFILE 4
- HIGH
- HIGH MEMORY
- PROFILE 7
- PROFILE 8
- PROFILE 9

3.4.4 Transmitter I/O Screen

The Transmitter I/O screen is not available for all modulations.

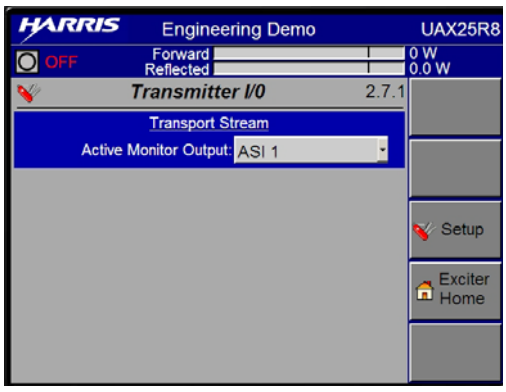


Figure 3-18 Transmitter I/O Screen

WARNING: Disconnect primary power prior to servicing.

Table 3-15 Xmtr Home>Exciter Home>Setup>Transmitter I/O

Field	Explanation
Transport Stream Sub Window	
Active Monitor Output	Displays active transport stream. ASI(HP1), ASI(LP1), SMPTE 1 ASI (HP 2), SMPTE 2 ASI (LP 2), or Follow Input Stream.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.4.5 PFRU Setup

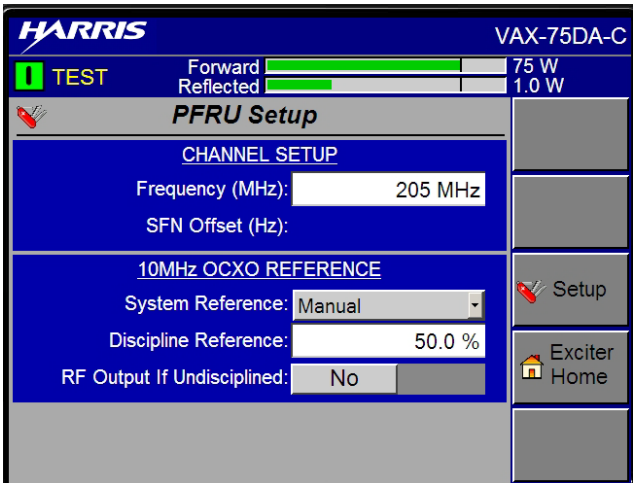


Figure 3-19 PFRU Setup Screen

Table 3-16 Xmtr Home>Exciter Home>Setup>PFRU

Field	Explanation
CHANNEL SETUP sub window	
Frequency (MHz)	Enter licensed frequency in MHz with decimals.
SFN Offset (Hz)	Field is available if SFN option is installed and functioning.
10MHz OXCO REFERENCE sub window	
System Reference	- Internal GPS (from internal GPS receiver) - Ext. 10 MHz reference input - Ext. 1PPS reference input - Manual (Control of 10 MHz reference oscillator from the Discipline Reference window.) The 10 MHz OCXO (Oven Controlled crystal (X) Oscillator) is the reference source for the 1st and 2nd local oscillators. It can be locked, via a PLL (Phase Locked Loop), to an external 1PPS signal from a GPS receiver, to an external 10 MHz reference, or to the internal GPS receiver.

WARNING: Disconnect primary power prior to servicing.

Table 3-16 Xmtr Home>Exciter Home>Setup>PFRU

Field	Explanation
Discipline Reference	OCXO manual setting, from 1% to 100%, is obtained by entering as a number in the range of 1 to 100. This provides a control voltage for the 10 MHz OCXO reference oscillator when Manual setting of the System Reference is selected. This voltage replaces the phase detector output voltage which controls the 10 MHz OCXO reference oscillator when any of the other Reference Source is selected. The OCXO frequency increases as the control number is increased. The relationship between the number entered and the 10 MHz frequency is as follows: 1% ~ 9.9999914 MHz. (This is the low end) 50% ~ 10.0000008 MHz. (This is the typical starting point.) 100% ~ 10.0000107 MHz. (This is the high end.)
RF Output If Undisciplined	Yes/No. If No is selected, the output will be muted if the 10 MHz OCXO reference oscillator looses lock. This can occur when the External 10 MHz reference, External 1PPS reference, or Internal GPS Reference choice is selected for the Reference source. It will have no effect if the OCXO is operated in Manual. If Yes is selected, the system will continue to produce RF power after reference loss unless another fault is present.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.4.6 Remote Communications Screens

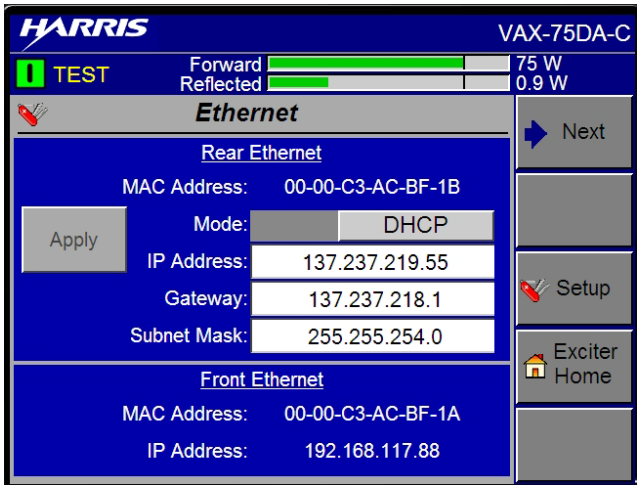


Figure 3-20 Remote Comms Ethernet Screen 1

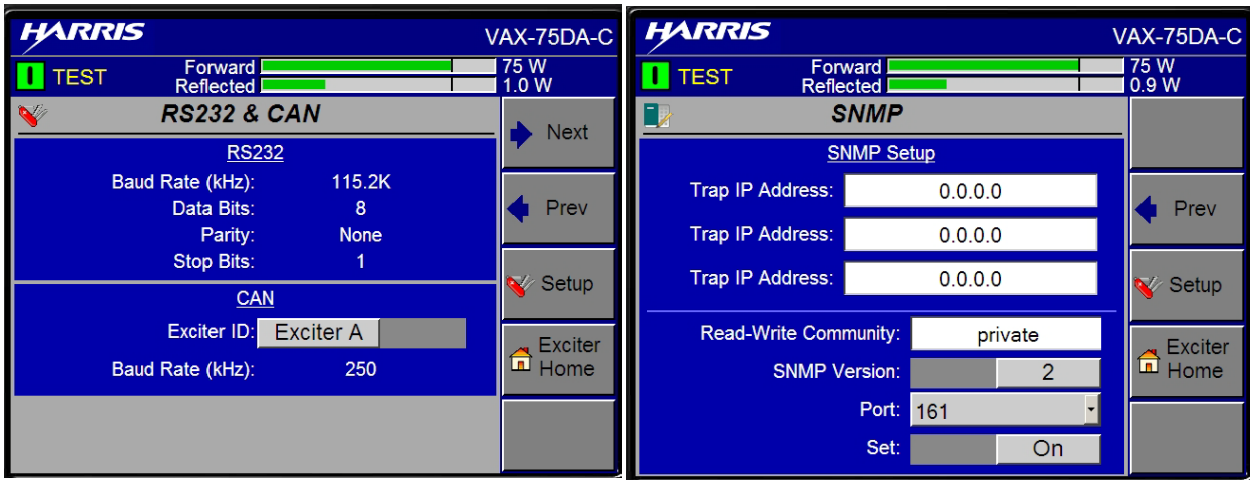


Figure 3-21 Remote Comms RS232 & CAN and SNMP

WARNING: Disconnect primary power prior to servicing.

Table 3-17 Xmtr Home>Exciter Home>Setup>Remote Communications

Field	Explanation
Rear Ethernet Sub Window	
MAC Address	Fixed rear Ethernet port MAC (Media Access Control) address is displayed.
Mode	Select DHCP (Dynamic Host Control Protocol) or Static. If Static is selected, click into and fill fields (obtained from your IT system administrator): IP, Gateway, & Subnet Mask.
Apply	Select Apply soft key to implement changes
Front Ethernet Sub Window: For information on how to connect to the Front Ethernet port, see Section "5.12.4 Connection Via Front Ethernet Connector" on page 5-34.	
MAC Address	Fixed MAC address is displayed. This is required to change feature key.
IP Address	Fixed IP address is displayed.
RS232 & CAN Sub Window	
Baud Rate (kHz), Data Bits, Parity & Stop Bits	These values are displayed. Use these values when connecting via RS232.
Exciter ID	Enter Exciter A or B. Note: When dual exciters are used they must be set to different values. If both are set to Exciter A control problems will result and the transmitter will cycle on and off.
Baud Rate (kHz)	Baud rate is displayed.
SNMP Setup	
Trap IP Address	A list of the IP addresses to which any generated SNMP traps will be sent.
Read-Write Community	This is a password which allows a set to be performed. Default is ‘private’
SNMP Version	Choices are 1 or 2C. Version 1: The trap which is sent tells of an occurrence of an event but gives no details. Version 2C: This trap tells of an occurrence of an event and gives details concerning it.
Port	Port number.
Set	Choices are Off/On.

Table 3-17 Xmtr Home>Exciter Home>Setup>Remote Communications

Field	Explanation
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

3.4.7 User Settings Screen

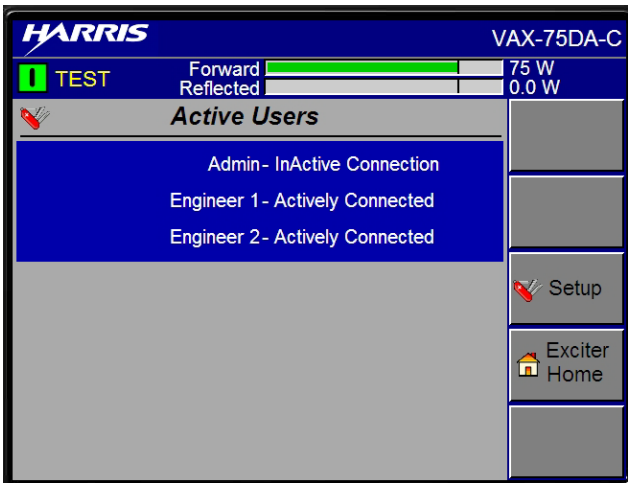


Figure 3-22 User Settings Screen

Table 3-18 Xmtr Home>Exciter Home>Setup>User Settings

Fields	Explanation
Active Users	Lists active Engineer level and NetAdmin level users that are logged into LPU via web browser.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

If logged in as a system administrator using ‘netadmin’ username and ‘harris’ password (initial default values) the Active Users screen will appear with an edit box. Pressing the edit box (Figure 3-23) opens a screen that allows changes to usernames and passwords.

WARNING: Disconnect primary power prior to servicing.

See 5.12.3 on page 5-33 for additional information on password change procedures.

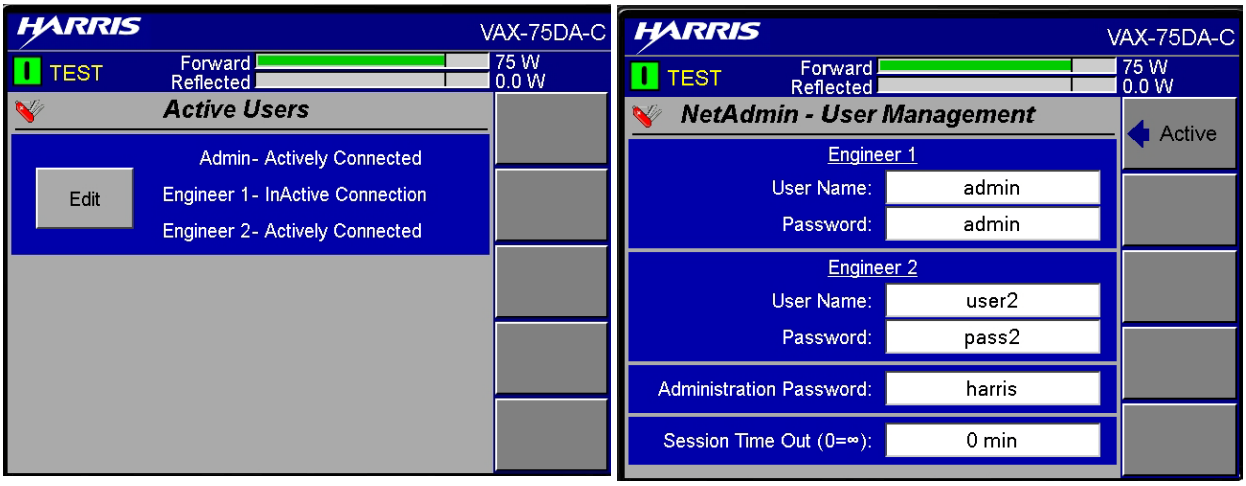


Figure 3-23 Netadmin Screens

3.4.8 System Settings Screens

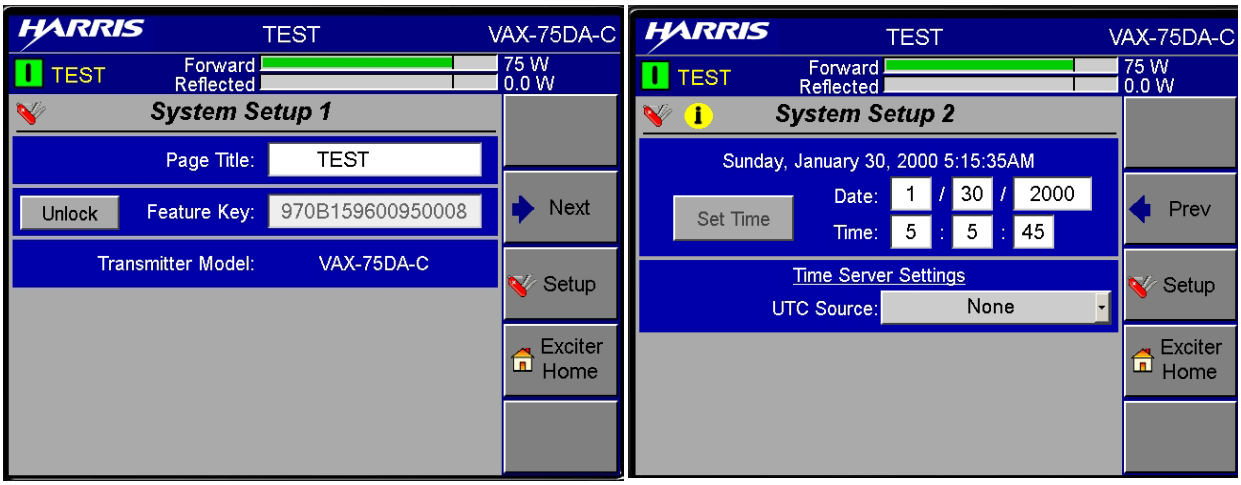


Figure 3-24 System Settings Screens

Table 3-19 Xmtr Home>Exciter Home>Setup>System Settings & >Next

Fields	Explanation
Page Title	Allows user to change the reference title located at the top of the screen above the forward power bar. This title is shown on every screen.
Feature Key	Enter a factory supplied feature key. ***Note:*** The new feature key will become active only after a transmitter reboot. This can be accomplished with the Reset key on the ISP screen.
Transmitter Model	Model number is set by feature key and the modulation standard that is loaded into the unit.
Day, Date, Time	Current date and time is displayed. Settings can be changed if UTC Source is set to None.
UTC Source	Drop menu and choose: None, GPS, or NTP. None: The Set Time window will be displayed to allow the user to set the time manually (see Figure 3-24 on right).
UTC Offset Hrs	Enter appropriate time zone offset.
UTC offset Min	Enter appropriate time zone offset in minutes if applicable.
NTP Server IP Address	The NTP Server Settings sub window allows the user to input the NTP Server IP Address (see Figure 3-24 right). Press Set IP button to accept the new address.

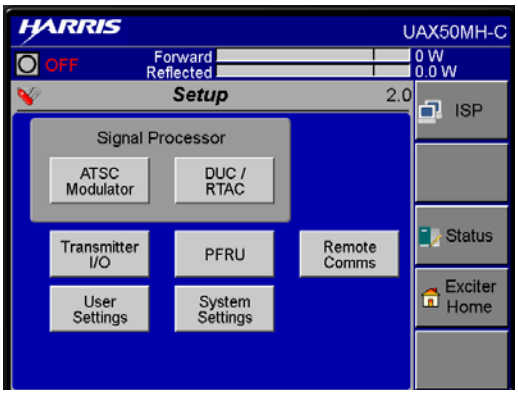
WARNING: Disconnect primary power prior to servicing.

Table 3-19 Xmtr Home>Exciter Home>Setup>System Settings & >Next

Fields	Explanation
Softkeys	
Setup	Pressing this soft key displays the Main 'Setup' Screen in Figure 3-14 on page 3-21. This screen accesses the various setup screens for the transmitter. See Section "3.4 SETUP SCREENS, All Modulation Systems" on page 3-21
Exciter Home	Pressing this soft key displays Exciter Home Screen, Figure 3-12 on page 3-17.

WARNING: Disconnect primary power prior to servicing.

3.5 Setup Screens - ATSC Modulation



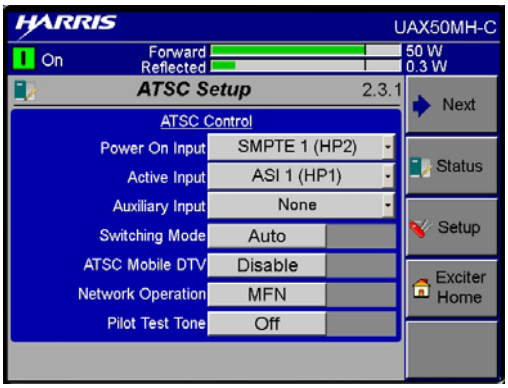


Figure 3-25 ***on left*** **- ATSC Setup** ***on right*** **- ATSC Modulator Setup Screen 1**

Table 3-20 Xmtr Home>Exciter Home>Setup>ATSC Modulator (screen 1)

Fields	Explanation
Power On Input	Configures which input will be used after a power failure.
Active Input	Selects which input is to be used actively by the modulator. Input choices and rear panel connectors are shown in "2.7.4 TS (Transport Stream) Connections" on page 2-14. The input availability and functionality vary with modulation type. These inputs are not available for analog modulation.
Auxiliary Input	This is the backup input to substitute for the Primary if the Switching Mode is set to Automatic.
Switching Mode	Choices are**:** Auto(matic) or Manual**.** Selects how the VAX-C is to change inputs if the selected input is lost. In the Automatic mode, if one input (Primary-Active or Auxiliary) is missing and the other is present, the input choice will automatically switch to the input which is present. If both inputs are present, the Primary (Active) input will be selected.
ATSC Mobile DTV	Choices are Enable or Disable.
Network Operation	Choices are MFN (Multi Frequency Network) or SFN (Single Frequency Network).
Pilot Test Tone	Choices are On or Off.
Softkeys	
ISP	Pressing this soft key displays the ISP 'In-System Programming' Screen shown in Figure 3-15 on page 3-22. The ISP screen is used to load software into the transmitter.

WARNING: Disconnect primary power prior to servicing.

Table 3-20 Xmtr Home>Exciter Home>Setup>ATSC Modulator (screen 1)

Fields	Explanation
Status	Displays Status screen.
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

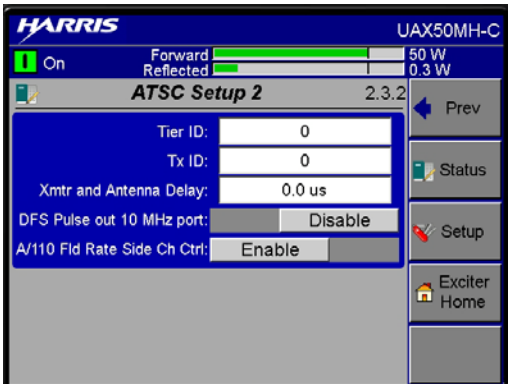


Figure 3-26 ATSC Modulator Setup Screen 2

Table 3-21 Xmtr Home>Exciter Home>Setup>ATSC Modulator>Next (screen 2)

Fields	Explanation
Tier ID	Tier of the network that this transmitter / exciter corresponds to in accordance with ATSC's A/110 standard. This data must match the tier setting that has been set up in the Distributed Transmission Adapter upstream.
TX ID	Designates which transmitter this is in accordance with the Distributed Transmission network design, in accordance with ATSC's A/110 standard. This Tier and Transmitter must match the tier and transmitter settings that are set back at the studio or network control point in the Distributed Transmission Adapter for this transmitter.
Transmitter and Antenna Delay	Enter the delay value in microseconds. This is the throughput delay of the RF signal after it leaves the exciter network delay circuit and travels through the rest of the transmitter, transmission line, and antenna. It is also known as “TAD”, this is a calculated or estimated number that is incorporated in compliance with the ATSC A/110 Distributed Transmission standard. The exciter will use this value as part of it's calculation of emission time.

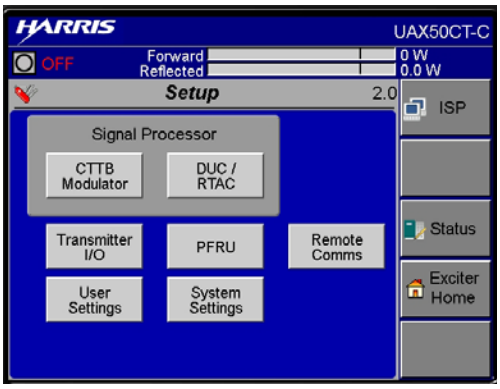
WARNING: Disconnect primary power prior to servicing.

Table 3-21 Xmtr Home>Exciter Home>Setup>ATSC Modulator>Next (screen 2)

Fields	Explanation
DFS Pulse out 10 MHz port	Choices are Enable and Disable. Enabling this function will disable the 10 MHz signal coming out of the front panel 10 MHz port and replace it with a 77 uS pulse that is coincident with the emission of the Data Field Sync portion of the ATSC signal. Using this signal along with the 1 PPS signal, one could use an oscilloscope to adjust emission timing between two or more single frequency network sites.
A/110 Fld Rate Side Ch Ctrl	Choices are Enable and Disable. ATSC's A/110 standard defines a side communication channel, called the field rate side channel (FRSC). The FRSC may be used to populate certain symbols in the data field sync or communicate other information to the modulator e.g. configuration changes. However, information to populate the FRSC must be sent from the upstream Distributed Transmission Adapter or a Mobile DTV multiplexer. This control governs whether or not the FRSC information is used. If the upstream adapter is not inserting the FRSC information, set to Disable.
Softkeys	
Status	Displays Status screen.
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.6 Setup Screens - CTTB/CMMB Modulation



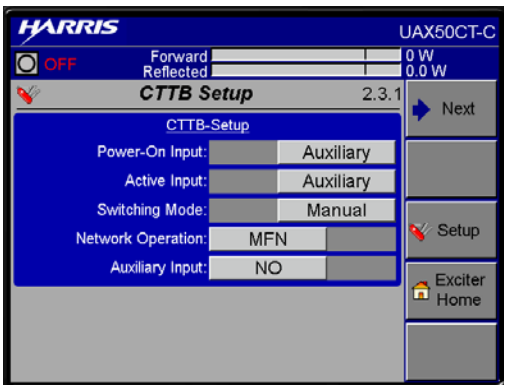


Figure 3-27 *on left* - CTTB Setup *on right* - CTTB Setup Screen 1

Table 3-22 Xmtr Home>Exciter Home>Setup>CTTB Modulator (screen 1)

Fields	Explanation
Power-On Input	The selected input, Primary (ASI 1) or Auxiliary (ASI 2), becomes the active input when the exciter is powered up.
Active Input	The selected input, Primary (ASI 1) or Auxiliary (ASI 2), is the active input
Switching Mode	Choices are Auto (automatic) or Manual switching of the ASI Transport stream. IF in the automatic mode and the current ASI stream has an issue or drops out, and the Auxiliary Input is set to Yes, the system will switch to the auxiliary ASI stream if it is available and good.
Network Operation:	Choices are MFN (multiple frequency network) or SFN (single frequency network). Consult the GB (National CTTB Standard of the People's Republic of China) specification on proper modes of operation and make sure the transport stream input rate feeding the modulator is at or below the allowed rate for the mode desired. In **MFN** mode, the user can select the CTTB parameters that are allowed. Consult the GB spec on proper modes of operation and make sure the transport stream input rate you are feeding the modulator is at or below the allowed rate for the mode desired.
Auxiliary Input:	Choices are No or Yes. If yes is selected the exciter can be made to switch to an auxiliary input if the active input faults or drops out.

WARNING: Disconnect primary power prior to servicing.

Table 3-22 Xmtr Home>Exciter Home>Setup>CTTB Modulator (screen 1)

Fields	Explanation
Softkeys	
ISP	Pressing this soft key displays the ISP 'In-System Programming' Screen shown in Figure 3-15 on page 3-22. The ISP screen is used to load software into the transmitter.
Status	Displays Status screen.
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

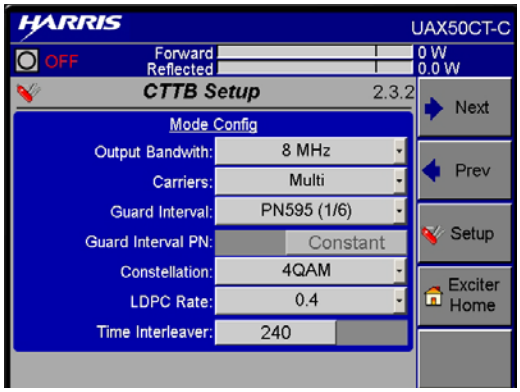


Figure 3-28 CTTB Setup Screen 2

Table 3-23 Xmtr Home>Exciter Home>Setup>CTTB Modulation>Next (screen 2)

Fields	Explanation
Output Bandwidth	Choices are 8 MHz, 7 MHz, 6 MHz or 5MHz.
Carriers	Choices are Multi, Single, or Two Pilot. Multi = COFDM type modulation, Single = single carrier modulation system, Two Pilot = single carrier modulation mode with two pilots.
Guard Interval	Choices are PN945 (1/4), PN595 (slightly less than 1/6), or PN420 (1/9). This is the length of the guard interval in symbols. The total frame length is 3780 symbols. Guard interval is the guard interval symbol length divided by the total symbol length. Example: 945/3780 = 1/4. The Guard Interval is the time, between symbol transmissions, when nothing is transmitted. The guard interval is entered as a fraction, which represents the guard interval time as a fraction of the useful symbol duration. Total symbol duration is the sum of the useful symbol duration plus the guard interval. In the 2k mode, useful symbol duration is 224 microseconds and in the 8k mode, useful symbol duration is 896 microseconds.
Guard Interval PN	Choices are variable or constant. Constant only used with PN595, Variable is used with PN945 and PN420.
Constellation	Choices are 4QAM, 16QAM, 32QAM, or 64QAM. Constellation refers to the size of each RF sub-carrier constellation. LDPC Rate**:** Choices are 0.4 (2/5), 0.6, (3/5) or 0.8 (4/5). The LDPC Rate provides three rates of forward error correction. The decimal, or fraction, gives the relative efficiency of the forward error correction by dividing the information bits by the total block length. For example, block length = 7488 bits, information bits = 3008, therefore: 3008/7488 = 0.4 or 2/5. This indicates that there are two information bits for every five output bits.
Time Interleaver	Choices are 240 symbols or 720 symbols. This is a data convolutional interleaver. The data is interleaved to a depth of 240 or 720 symbols.

WARNING: Disconnect primary power prior to servicing.

Table 3-23 Xmtr Home>Exciter Home>Setup>CTTB Modulation>Next (screen 2)

Fields	Explanation
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

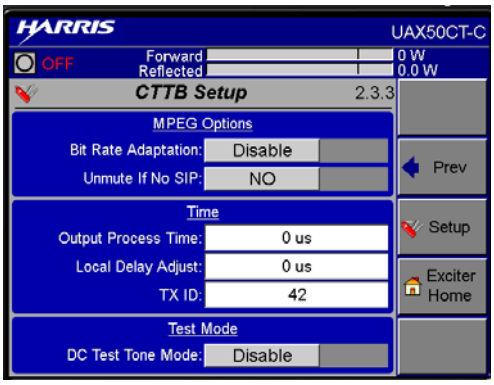


Figure 3-29 CTTB Setup Screen 3

Table 3-24 Xmtr Home>Exciter Home>Setup>CTTB Modulator>Next>Next (screen 3)

Fields	Explanation
Bit rate Adaptation	Choices are Enable or Disable. This applies only to MFN mode. Bit Rate Adaptation will drop all incoming null packets, introduce new null packets as appropriate to manage the data rate and restamp Program Clock Reference (PCR) appropriately. This is null packet insertion and PCR (program clock rate, time stamp to synchronize the receiver) restamp i ng.
Unmute if No SIP	Choices are Yes or No. Controls whether or not the VAX-C is released from mute if no SIP packet is detected in SFN mode. This is a network safeguard.
Output Process Time	The network distribution delay is calculated and displayed.The time settings apply to SFN mode.
Local Delay Adjust	Further transmission delay time is entered here by the operator to conform with the desired SFN design parameters.

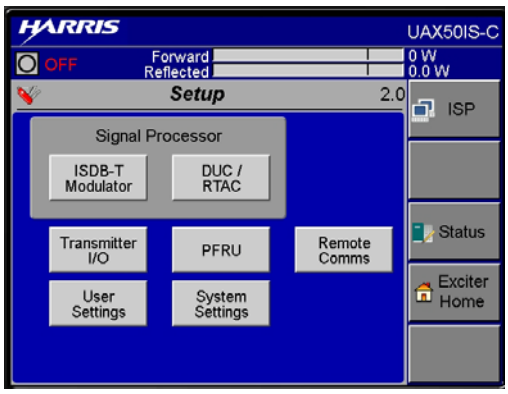
WARNING: Disconnect primary power prior to servicing.

Table 3-24 Xmtr Home>Exciter Home>Setup>CTTB Modulator>Next>Next (screen 3)

Fields	Explanation
TX ID	A transmitter ID field used to identify the transmitter. This corresponds to Cell ID in the GB spec so transmitter control via Cell ID is possible upstream via the SIP inserter.
DC Test Tone Mode	Enabling the DC Test Tone Mode transmits a single tone which is placed at the center of the spectrum. It is used to measure carrier frequency. The single tone signal is the same power as the exciter is putting out normally. With this being the same power level this should not cause any damage to the transmitter. Disabling the DC Test Tone Mode causes normal transmission to be resumed.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.7 SETUP - ISDB-T MODULATION



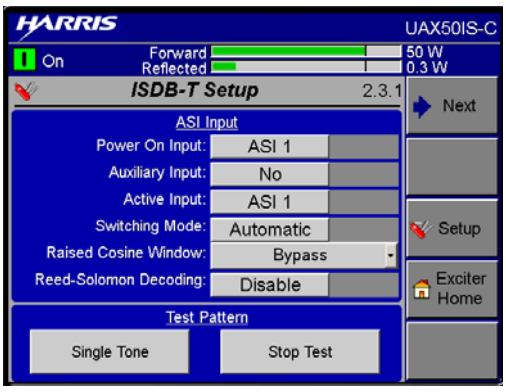


Figure 3-30 *on left* - ISDB-T Setup ***on right* - ISDB-T Setup Screen 1**

Table 3-25 Xmtr Home>Exciter Home>Setup>ISDB-T Modulator (screen 1)

Fields	Explanation
Power On Input	The selected input, ASI 1 or ASI 2, becomes the active input when the exciter is powered up.
Auxiliary Input	Choices are No or Yes. If yes is selected the exciter can be made to switch to an auxiliary input if the active input faults or drops out.
Active Input	The selected input, ASI 1 or ASI 2, is the active input.
Switching Mode	Choices are Automatic or Manual switching of the ASI Transport stream. If the ASI switch mode is in Automatic and the current ASI stream has an issue, or drops out, the system will switch to the Auxiliary ASI stream if it is available and good.
Raised Cosine Window	This entry enables Raised Cosine Window shaping between OFDM symbols to reduce out-of-band distortion. Up and down arrows allow the selection of Bypass, Min (minimum), Med (medium), or Max (maximum) raised cosine functions.
Reed-Solomon Decoding	This entry allows Reed-Solomon Decoding to be Enabled or Disabled on the incoming transport stream. Reed-Solomon Decoding must be enabled only when the transport stream contains RS encoding.
Test Pattern	Pressing the Single Tone soft key in the test pattern sub window causes a single tone, placed at the center of the spectrum, to be transmitted. It is used to measure the channel carrier frequency. The single tone signal is the same power as the exciter is putting out normally. Normal transmission is resumed by pressing the Stop Test soft key.
Softkeys	

WARNING: Disconnect primary power prior to servicing.

Table 3-25 Xmtr Home>Exciter Home>Setup>ISDB-T Modulator (screen 1)

Fields	Explanation
ISP	Pressing this soft key displays the ISP 'In-System Programming' Screen shown in Figure 3-15 on page 3-22. The ISP screen is used to load software into the transmitter.
Status	Displays Status screen.
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

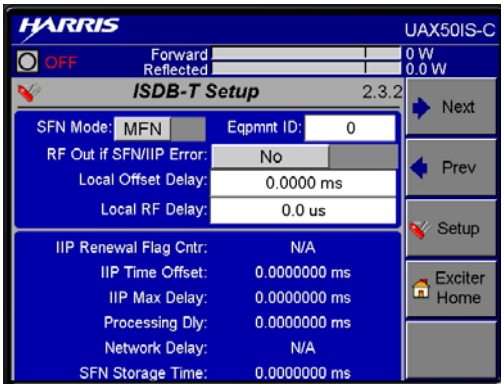


Figure 3-31 ISDB-T Setup Screen 2

Table 3-26 Xmtr Home>Exciter Home>Setup>ISDB-T Modulator >Next (screen 2)

Fields	Explanation
SFN Mode	Choices are MFN (Multiple Frequency Network) or SFN (Single Frequency Network).
Eqpmnt ID	Range is 0 to 63. Equipment ID is assigned by the SFN network administrator and is provided to allow a unique identifier for each transmitter in the SFN cell. When the equipment ID in the IIP packet matches the local equipment ID, then the IIP Time Offset information is extracted
RF Output if SFN/ IIP Error	Choices are Yes or No. If no is selected, transmitter will be muted if SFN information is missing from the transport stream or SFN delay calculations result in negative delays or delays greater than one second. If yes is selected, the exciter will output RF which is not properly SFN synchronized.

WARNING: Disconnect primary power prior to servicing.

Table 3-26 Xmtr Home>Exciter Home>Setup>ISDB-T Modulator >Next (screen 2)

Fields	Explanation
Local Offset Delay	This allows the transmitter operator to set a delay for the transmitter locally. Its purpose is to cause the RF output to be delayed additionally by the amount entered.
Local RF Delay	This is the time delay caused by the transmitter's high power filter and transmission line as well the GPS delay caused by its cable length. Its purpose is to cause the RF output to be released earlier by the amount entered thereby nulling out the above mentioned RF delays.
IIP Renewal Flag Cntr (counter)	Renewal Flag is a bit in the IIP packet which, on the transition from 1 to 0, indicates the information in the IIP packet is valid. The renewal flag counter provides the operator with an indication that the IIP information is being updated on a regular bases. Note that the Max Delay and IIP Time Offset is only updated when the IIP Renewal Flag changes from 1 to 0. On exciter power up, the modulator will wait for an IIP renewal flag transition from 1 to 0, which indicates the IIP packet data is valid.
IIP Time Offset	The IIP Time Offset, in ms, allows the SFN Adapter upstream to send an offset time to individual transmitters in the SFN network. This allows the SFN network operator to change any of the transmitter delays in the SFN from one central location, the SFN adapter.
IIP Max Delay	This delay is sent from the SFN Adaptor to the modulator. It indicates the time from the time stamp in the IIP packet to when the head of the multiplexed frame is to be emitted.
Processing Delay	Processing Delay, in ms, is the time required for the signal to propagate thru the modulator during the modulation process. This time omits the delay caused by the time interleaver.
Network Delay	This time in ms is the time required for the transport stream to travel from where the IIP packet is time stamped in the SFN adaptor until the packet is received by the modulator.
SFN Storage Time	Storage time, in ms is the Max Delay plus the local RF Delay, minus the processing Delay, minus the Local Offset Delay, minus the IIP Offset Delay, minus the Network Delay. SFN Storage Time is the delay buffer incorporated in the modulator to provide the required delay for SFN operation.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

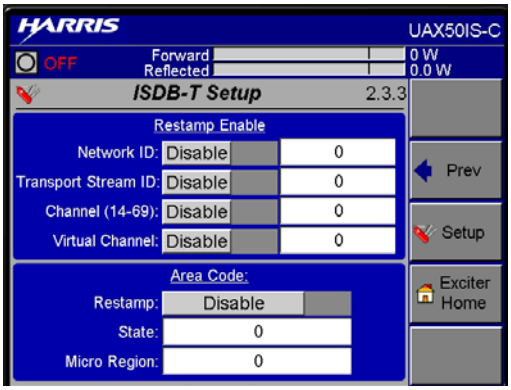


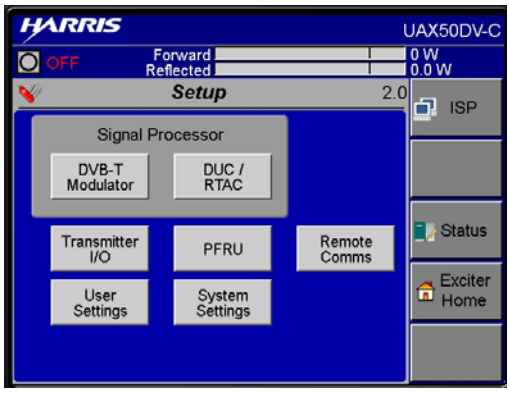
Figure 3-32 ISDB-T Setup Screen 3

Table 3-27 Xmtr Home>Exciter Home>Setup>ISDB-T Modulator>Next>Next (screen 3)

Fields	Explanation
Network ID	Choices are Disable or Enable.
Transport Stream ID	Choices are Disable or Enable.
Channel (14-69)	Choices are Disable or Enable.
Virtual Channel	Choices are Disable or Enable.
Restamp	Choices are Disable or Enable.
State	Enter value in box.
Micro Region	Enter value in box.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.8 Setup Screens - DVB-T Modulation



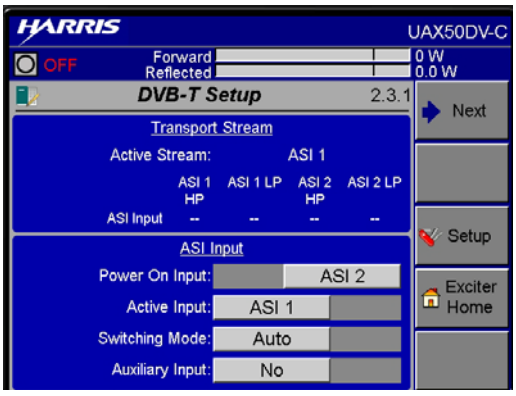


Figure 3-33 *on left* - DVB-T Setup ***on right* - DVB-T Setup Screen 1**

Table 3-28 Xmtr Home>Exciter Home>Setup>DVB-T Modulator (screen 1)

Fields	Explanation
Transport Stream	See TS input connectors and assignments in Section 2.7.4, "TS (Transport Stream) Connections".
Power-On Input	Choices are ASI 1, or ASI 2. This determines which input will be selected first on power-up.
Active Input	Choices are ASI 1, or ASI 2. This determines which input is currently the source of data for modulation.
Switch Mode	Choices are Auto (automatic) or Manual.
Auxiliary Input	Choices are Yes or No. Selects whether the auxiliary input is allowed. This needs to be set to YES in order to manually or automatically switch to the auxiliary input.
Softkeys	
ISP	Pressing this soft key displays the ISP 'In-System Programming' Screen shown in Figure 3-15 on page 3-22. The ISP screen is used to load software into the transmitter.
Status	Displays Status screen.
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

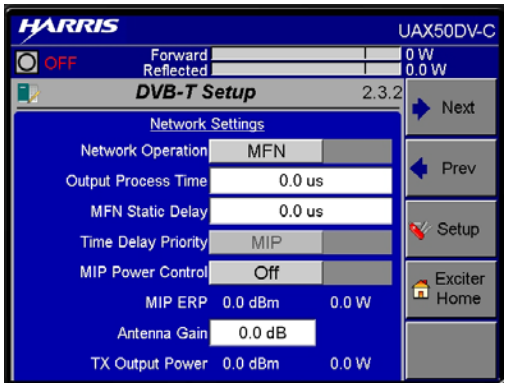


Figure 3-34 DVB-T Setup Screen 2

Table 3-29 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next (screen 2)

Fields	Explanation
Network Operation	Select MFN (Multi Frequency Network) or SFN (Single Frequency Network). MFN mode selects operation in a Multiple Frequency Network (transmitters on different frequencies) which does not require synchronization with the other transmitters in a network. SFN mode selects operation in Single Frequency Network (transmitters on same frequency) which requires synchronization with other transmitters in a network. If SFN is selected a GPS antenna is required and internal GPS is selected on the PFRU set up screen found on Figure 3-19 on page 3-33. This applies to every modulation mode that supports SFN.
Output Process Time	Enter a value in microseconds (uS). Time settings are used to synchronize the transmission timing for single frequency networks.
MFN/SFN Static Delay	This entry appears when the MFN or SFN network option is active. The range is -10000us...+10000uS. The value can be entered locally or controlled by MIP. See Time Delay Priority (Local or MIP) below.
Time Delay Priority	Choices are Local or MIP. Local uses a locally entered time delay. When MIP is selected, the time delay is sent via the MIP packet, which is sent over the SFN network
MIP ERP	Display only, in dBm and watts. This entry, as well as the Antenna Gain and Xmtr Output Power entries, allow the operator to set the ERP of the VAX transmitter driven system remotely by a value sent in the MIP packet from Syncrony.
Antenna Gain	Enter antenna Gain in dB. This entry allows the ERP for this station to be set remotely by varying the transmitter output power.
Xmtr Output Power	Display only, in dBm and watts.

WARNING: Disconnect primary power prior to servicing.

Table 3-29 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next (screen 2)

Fields	Explanation
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

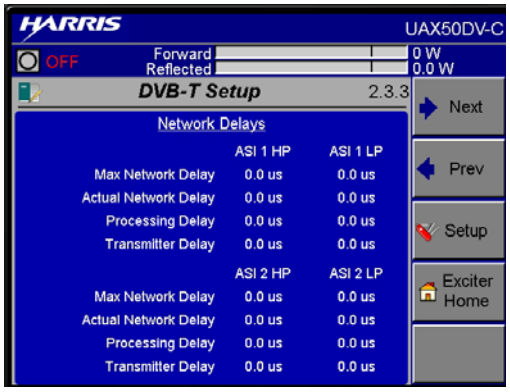


Figure 3-35 DVB-T Setup Screen 3

Table 3-30 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next(screen 3)

Fields	Explanation
Max(imum) Network Delay	Value in microseconds for HP or LP modes. Maximum Network Delay is configured for an SFN network and sent in the MIP packet.
Actual Network Delay	Value in microseconds (us) for HP or LP modes. Actual Network Delay is the delay of the transport stream from the Single Frequency Network adapter to the VAX-C.
Processing Delay	Value in microseconds (us) for HP or LP modes. Time that the transport packets are delayed in the VAX-C memory buffer.
Transmitter Delay	Value in microseconds (us) for HP or LP modes. Total delay of the signal in the VAX-C including internal processing delay and storage time.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

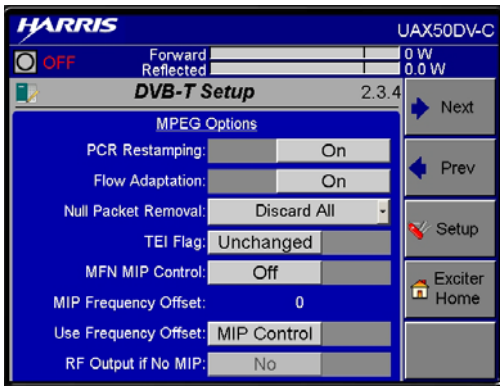


Figure 3-36 DVB-T Setup Screen 4

Table 3-31 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x3 (screen 4)

Fields	Explanation
PCR Restamping	Choices are Off or On. This is PCR (Program Clock Reference) Restamping of transport packets. For a SFN, this function must be disabled. Either setting is valid in MFN mode, but it is usually On
Flow Adaptation	Choices are Off or On. Enables or disables the transport stream flow (bit rate) adaptation by the addition or deletion of null packets. For a SFN, this function must be disabled. Either setting is valid in MFN mode, but it is usually ON.
Null Packet Removal	Choices are Keep All, Discard Min(imum), or Discard All. Keep All = All incoming null packets are kept. Discard Min = Discard the minimum number of Null packets to meet required data rate. Discard All = Discard all incoming null packets. For a SFN, this function must be set to Keep All. Any setting is valid in MFN mode, but Discard All is usually selected
TEI Flag	Choices are Unchanged or Set. If Set is chosen, the TEI (Transport Error Indicator) flag is enabled in each transport stream packet. This is used to indicate uncorrected errors in the input transport stream. In the SFN operating mode, this function must be set to Unchanged, where the TEI flag will remain disabled. In the MFN mode, either setting can be used
MFN MIP Control	MIP is Mega-frame Initialization Packet. On Enables the use of MIP packets in MFN mode. Select On if MIP packets are to be used to control modulation parameters.
MIP Frequency Offset	No value can be entered. This is for Status only. MIP Frequency Offset is an optional frequency offset included in the MIP packet and added to RF frequency.
Use frequency Offset	Choices are Local or MIP Control

WARNING: Disconnect primary power prior to servicing.

Table 3-31 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x3 (screen 4)

Fields	Explanation
RF Output if No MIP	Choices are Yes or No. This allows mute of VAX-C if no MIP packets are detected and they are required. MIP packets are needed in the SFN mode.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

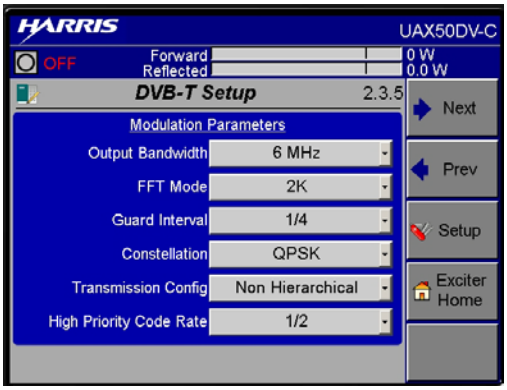


Figure 3-37 DVB-T Setup Screen 5

Table 3-32 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x4 (screen 5)

Fields	Explanation
These parameters can only be changed by GUI when in MFN mode. In SFN mode these parameters are read from MIP (Mega-frame Initialization Packet) packets in transport stream input	
Output Bandwidth	Choices are 8 MHz, 7 MHz, 6 MHz or 5MHz.
FFT Mode	This sets the size of the modulation Fast Fourier Transform (FFT), which in turn sets the number of subcarriers used in the COFDM (Coded Orthogonal Frequency Division Multiplex) signal. It also selects whether the in-depth interleaver (8k) is enabled in 2k and 4k mode. Choices are 2k, 2k (8k interlaced), 4k, 4k (8k interlaced), or 8k.

WARNING: Disconnect primary power prior to servicing.

Table 3-32 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x4 (screen 5)

Fields	Explanation
Guard Interval	Choices are 1/4, 1/8, 1/16, and 1/32. The Guard Interval is the time, between symbol transmissions, when nothing is transmitted. The guard interval is entered as a fraction, which represents the guard interval time as a fraction of the useful symbol duration. Total symbol duration is the sum of the useful symbol duration plus the guard interval. In the 2k mode, useful symbol duration is 224 microseconds and in the 8k mode, useful symbol duration is 896 microseconds.
Constellation	Choices are QPSK (Quadrature Phase Shift Keying), 16 QAM (Quadrature Amplitude Modulation), and 64 QAM. Constellation refers to the size of each RF sub-carrier constellation. When using the hierarchical mode, 16 QAM or 64 QAM must be selected.
Transmission Config(uration)	Choices are Non Hierarchical or Hierarchical. Non Hierarchical modulation allows transmission of only one data stream, the HP (High Priority) input. Hierarchical modulation allows transmission of two data streams, the LP (Low Priority) and the HP (High Priority) transport stream inputs. The Low Priority stream has a higher data rate which produces a higher quality reproduction, but it is less robust and therefore covers a limited distance. The High Priority stream has a lower data rate which produces a lower quality reproduction, but it is more robust and therefore covers a greater distance.
High Priority Code Rate	Choices are 1/2, 2/3, 3/4, 5/6, and 7/8. These choices affect the convolutional encoder code rate for the High Priority channel. It offers a choice between the useful data rate (picture and sound quality) verses signal robustness (distance the signal can be received). A code rate of 1/2 includes one forward error correction bit and one data bit. This yields a lower quality signal which can be received at a greater distance. A code rate of 7/8 includes one forward error correction bit for every seven data bits. This yields a higher quality signal which can be received at a much shorter distance.
Low Priority Code Rate	Low Priority Code Rate: Choices are: 1/2, 2/3, 3/4, 5/6, 7/8. The Low Priority Code Rate is only visible when in Hierarchical mode. These choices affect the convolutional encoder code rate for the low priority channel.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

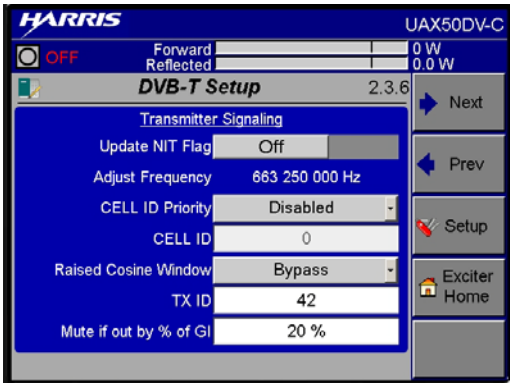


Figure 3-38 DVB-T Setup Screen 6

Table 3-33 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x5 (screen 6)

Fields	Explanation
Update NIT Flag	Choices are Disabled or Enabled. Update NIT (Network Information Table) Flag allows the update of the NIT packet with VAX-C RF frequency. This is only selectable in MFN mode.
Adjust(ed) Frequency	VAX-C RF frequency which is to be inserted in NIT. No value can be entered. This is for display only.
Cell ID Priority	Choices are Disabled, MIP (Mega-Frame Initialization Packet) Cell ID, or Local Cell ID. Selects source of Cell ID to be inserted in TPS (Transport Parameter Signalling) bits. Disabled: No Cell ID is inserted in TPS bits. MIP Cell ID: value of Cell ID read from MIP packet. No value can be entered, this is for display only. Local Cell ID**:** value of Cell ID to insert in TPS bits, range is 1-65535.
Cell ID	Displays value of Cell ID
Raised Cosine Window	Choices are Bypass (no windowing), Minimum, Medium, or Maximum. This entry enables Raised Cosine Window shaping between OFDM symbols to reduce out-of-band distortion. The window lengths, a fraction of symbol duration, depend on length of the guard intervals, as shown below. If Guard Interval is 1/32, then MIN = 1/512, MED = 1/128, MAX = 1/64. If Guard Interval is 1/16, then MIN = 1/512, MED = 1/128, MAX = 1/32. If Guard Interval is 1/8, then MIN = 1/512, MED = 1/128, MAX = 1/16. If Guard Interval is 1/4, then MIN = 1/512, MED = 1/128, MAX = 1/8.
TX ID	Is the transmitter identifier in a single frequency network. This will enable MIP packet optional parameters that are set for this transmitter ID value. Transmitter ID range to be entered is 1-65535.

WARNING: Disconnect primary power prior to servicing.

Table 3-33 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x5 (screen 6)

Fields	Explanation
Mute if out by % of GI	Allowable entry range is 5% to 50%. In SFN mode, the exciter will mute when 1 pps reference is missing (and exciter 10 MHz OCXO is flywheeling) after the timing error becomes too large. User can specify the allowed error in timing as a percentage of guard interval (GI) from 5% to 50% (default is 20%).
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

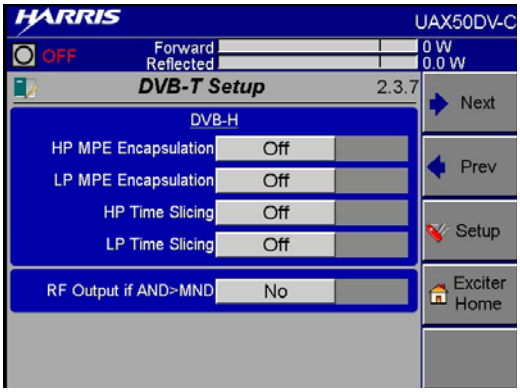


Figure 3-39 DVB-T Setup Screen 7

Table 3-34 Xmtr Home>Exciter Home>Setup>DVB-T Modulator Next x6 (screen 7)

Fields	Explanation
The DVB-H configuration sets information in the TPS (Transport Parameter Signaling) bits that pertain only to DVB-H mode. The programming choices for all four entries are **On** or **Off**, see the following for more information. These parameters can only be set in MFN mode. In SFN mode these fields display the settings read from the MIP packet.	
HP MPE Encapsulation	Sets TPS bits to indicate if MPE Encapsulation is used with high priority stream. Programming choices are On or Off.
LP MPE Encapsulation	Sets TPS bits to indicate if MPE encapsulation is used with low priority stream. Programming choices are On or Off.
HP Time Slicing	Sets TPS bits to indicate if time slicing is used with high priority stream. Programming choices are On or Off
LP Time Slicing	Sets TPS bits to indicate if time slicing is used with low priority stream. Programming choices are On or Off
RF Output If AND > MND	Choices are Yes or No. AND = actual network delay. MND = maximum network delay. Choosing yes allows the transmitter to operate if the actual network delay exceeds the maximum allowable network delay.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

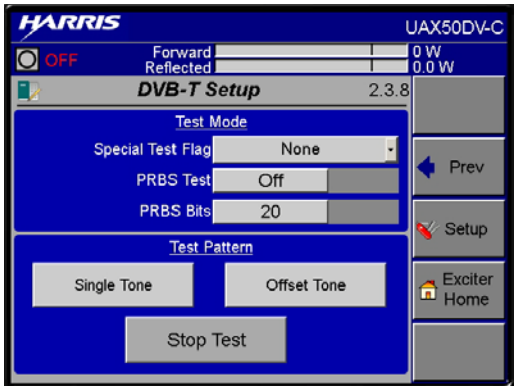


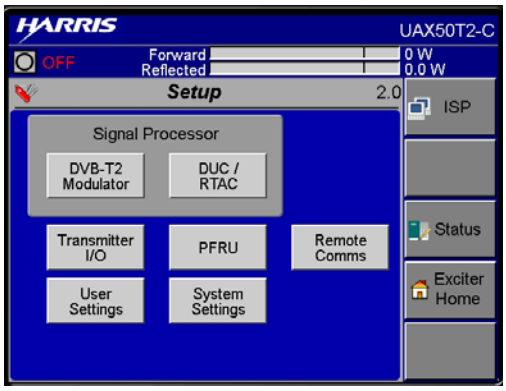
Figure 3-40 DVB-T Setup Screen 8

Table 3-35 Xmtr Home>Exciter Home>Setup>DVB-T Modulator>Next x7 (screen 8)

Fields	Explanation
These special test modes will cause errors and should not be used in normal operation.	
Special Test Flag	Choices are None, Test Sync, and Test Spectrum. None: No special tests are selected. Test Sync: One OFDM packet at the beginning of each Mega-Frame is deleted. This helps to measure alignment of VAX-C output in SFN mode. Test Spectrum**:** Sub-carriers in center of band are deleted to create a spectral null. This is used to evaluate spectral regrowth due to transmitter or other non-linear distortion.
PRBS Test	Choices are On or Off. PRBS (Pseudo Random Binary Sequence) On generates a test pattern instead of processing an input stream. It is only used by for testing. On is selected when transmitter RF output is desired but a valid transmission stream is not available. When On is selected the PRBS Test box will turn yellow on the GUI display. Since this is a test mode it will show up in the fault log upon activation. It will also cause an amber flashing output light on the front of the VAX-C and the system fault LED will also light on the VAX-C. The PRBS test function should not be enabled during normal operation with a valid transport stream. If a power interruption occurs with the PRBS test mode enabled it will be automatically disabled when system power is restored.
PRBS Bits	20 is default value.
Test Pattern	Single Tone: Test mode. Offset Tone: Test mode. Stop Test: Stops test patterns.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.9 Setup Screens - DVB-T2 Modulation



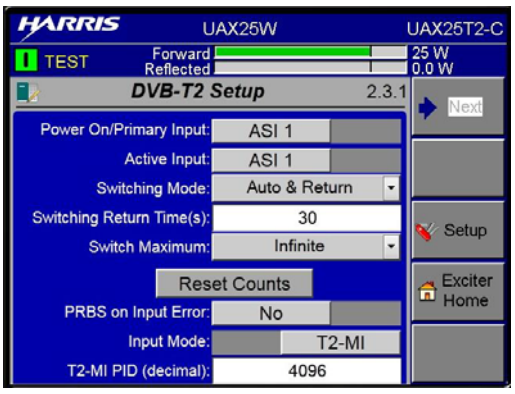


Figure 3-41 ***on left*** **- DVB-T2 Setup** ***on right*** **- DVB-T2 Setup Screen 1**

Table 3-36 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator (screen 1)

Field	Explanation
Power On/Primary Input	The choices are ASI 1 or ASI 2. This determines which input will be selected on power-up.
Active Input	The selected input (ASI 1or ASI 2) is the active input. This determines which input is the current modulator data source.
Switching Mode	Choices are Manual, Auto or Auto & Return switching of the ASI Transport stream. If the ASI switching mode is in Auto and the current ASI stream has an issue, or drops out, the system will switch to the Auxiliary ASI stream if it is valid and available.
Switch Return Time (s)	Enter integer between 0 and 600 seconds. Sets time before switchback to primary input.
Switch Maximum	Enter value from 1,2, 5, 6, 10, 11 or Infinite.
Reset Counts	Press button to reset the number of switch counts.
PRBS on Input Error	Yes or No. Yes activates PRBS stream in case of input error. No allows RF mute to occur in case of input error.
Input Mode	Choices are or MPEGT YD or T2-MI. T2 MI is the DVB-T2 modulator interface.
T2-MI PID (decimal)	This value is used for encapsulation of T2-MI packets in MPEG transport stream.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

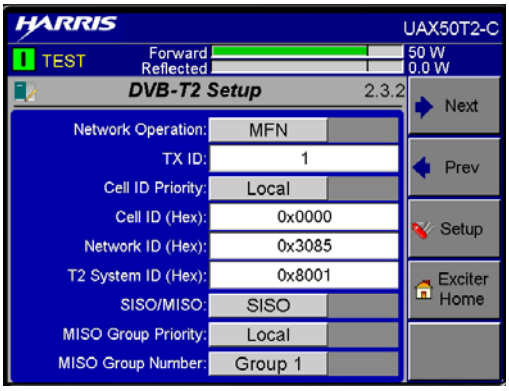


Figure 3-42 DVB-T2 Setup Screens 2

Table 3-37 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next (screen 2)

Field	Explanation
Network Operation	Select MFN (multi frequency network) or SFN (single frequency network). MFN mode selects operation in a multiple frequency network (transmitters on different frequencies) which does not require synchronization with the other transmitters in a network. SFN mode selects operation in single frequency network (transmitters on same frequency) which requires synchronization with other transmitters in a network. If SFN is to be the modulation choice then a GPS antenna is needed and internal GPS must be selected on the PFRU set up screen.
TX ID	Transmitter identifier used to address individual transmitters or modulators.
Cell ID Priority	Choices are Local, T2MI L1PRE, or Indiv Address.
Cell ID (Hex)	Identifies a geographic cell in a DVB-T2 network.
Network ID (Hex)	This field uniquely identifies the current DVB network.
T2 System ID (Hex)	This uniquely identifies a T2 system within the DVB network.
SISO/MISO	Choices are SISO (single input, single output) or MISO (multiple input, single output).
MISO Group Priority	Choices are Local or TCM1.
MISO Group Number	Choices are Group 1 or Group 2.

WARNING: Disconnect primary power prior to servicing.

Table 3-37 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next (screen 2)

Field	Explanation
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

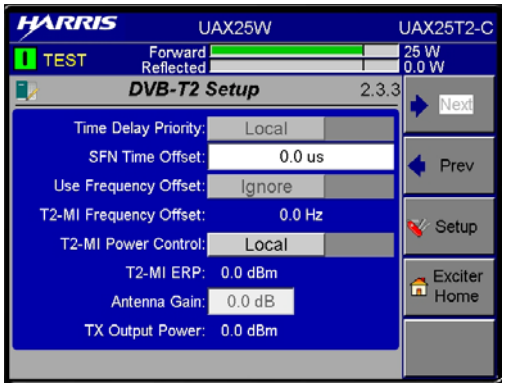


Figure 3-43 DVB-T2 Setup Screen 3

Table 3-38 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next x2 (screen 3)

Field	Explanation
Time Delay priority	Choices are Local or T2-MI. When local is selected, user enters offset in SFN time offset field. When T2-MI is selected, offset comes fromT2-MI packet.
SFN Time Offset	Enter appropriate delay value in microseconds when Time Delay Priority is in Local.
User Frequency Offset	Choices are Ignore or T2-MI. When ignore is selected, no offset is used. When T2-MI is selected, offset comes from T2-MI packet.
T2-MI Frequency Offset	0.0 Hz displayed when Use Frequency Offset is set to Ignore. When it is set to T2-MI, the T2-MI packet offset is displayed. Value displayed in Hz, when Use Frequency Offset is set to T2-MI.
T2-MI Power Control	Choices are Local or T2-MI. When local is selected, power is controlled at the transmitter. When T2-MI is selected, the ERP value from the T2-MI packet is used to control the transmitter power.
T2-MI ERP	Effective radiated output power from T2-MI packet.
Antenna Gain	Enter antenna gain value in dB. This entry is used to adjust the transmitter output power to achieve the desired ERP.

WARNING: Disconnect primary power prior to servicing.

Table 3-38 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next x2 (screen 3)

Field	Explanation
TX Output Power	Displays transmitter output power in dBm.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

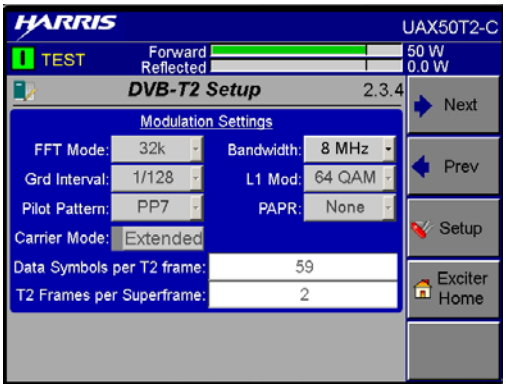


Figure 3-44 DVB-T2 Setup Screen 4

Table 3-39 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next x3 (screen 4)

Field	Explanation
FFT Mode	Choices are 1K, 2K, 4K, 8K, 16K, or 32K. This refers to the number of sub carriers in the RF output bandwidth. See Table 3-40 on page 67.
Grd Interval	Choices are 1/4, 1/8, 1/16, 1/32, 1/128, 19/128, or 19/256.
Pilot Pattern	Choices are PP1, PP2, PP3, PP4, PP5, PP6, PP7, or PP8. See Table 3-42 on page 68.
Carrier Mode	Choices are Normal or Extended.
Bandwidth	Presently 5 MHz, 6MHz, 7 MHz, and 8 MHz, in the future 1.7 MHz bandwidth will be added.

WARNING: Disconnect primary power prior to servicing.

Table 3-39 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next x3 (screen 4)

Field	Explanation
L1 Mode	Choices are BPSK, QPSK, 16QAM, or 64QAM. The L1 Mod referred to above gives a choice of the modulation constellation for the P2 symbol(s). L1 refers to the Layer 1 signalling within the T2 frame. L1 is split into three main sections: The P1 signalling, the L1-pre signalling and L1-post signalling. The the L1-pre and post signalling is carried by the P2 symbol(s), which may also carry data.
PAPR	Choices are None, ACE, TR, or ACE & TR.PAPR = peak to average power ratio. This choice allows two methods of peak to average power ratio reduction. TR = Tone Reservation ACE = Active constellation extension, The active constellation extension technique should not be applied when rotated constellations are used or when MISO is used.
Data Symbols per T2 frame	Programming range varies with the FFT size and the guard interval. The maximum number of data symbols per T2 frame is given in the table below. An odd number must be entered. If an even number or a number which is over the limit is entered, the exciter will mute. A larger number is more data efficient, but it also increases receiver lockup time.
T2 Frames per Superframe	A super-frame is composed of a set of T2-frames consisting of a particular number of consecutive T2-frames. A super-frame may include FEF (future extension frames) parts, two FEF parts can not be adjacent (must be separated by one or more T2 frames), and if FEFs are used, the super-frame ends with a FEF part. The maximum time for the super-frame length (TSF) is 64 seconds if FEFs are not used (equivalent to 255 T2 frames of 250 ms) and 128 seconds if FEFs are used. The maximum number of T2 frames are independent of the number of FEF parts used.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

Table 3-40 Number of Carriers and Carrier Spacing

FFT Mode (No. Carriers)	1K	2K	4K	8K	16K	32K
Theoretical Max. Carriers	1024	2048	4096	8192	16384	32768
No. Carriers Normal Mode	853	1705	3409	6817	13633	27265
No. Carriers Extended Mode	N/A	N/A	N/A	6912	13920	27840
Spacing Between Carriers Hz.	8929	4464	2232	1116	558	279

WARNING: Disconnect primary power prior to servicing.

Table 3-41 Guard Interval Duration Time in Microseconds

FFT Size	Guard Interval uS						
	1/128	**1/32**	**1/16**	**19/256**	**1/8**	**19/128**	**1/4**
32K	28	112	224	266	448	532	N/A
16K	14	56	112	133	224	266	448
8K	7	28	56	66,5	112	133	224
4K	N/A	14	28	N/A	56	N/A	112
2K	N/A	7	14	N/A	28	N/A	56
1K	N/A	N/A	7	N/A	14	N/A	28

Table 3-42 Scattered Pilot Patterns Allowed for SISO Mode

FFT Size	Scattered Pilot Patterns Allowed						
	1/128	**1/32**	**1/16**	**19/256**	**1/8**	**19/128**	**1/4**
32K	PP7	PP4 PP6	PP2 PP8 PP4	PP2 PP8 PP4	PP2 PP8	PP2 PP8	N/A
16K	PP7	PP7 PP4 PP6	PP2 PP8 PP4 PP5	PP2 PP8 PP4 PP5	PP2 PP3 PP8	PP2 PP3 PP8	PP1 PP8
8K	PP7	PP7 PP4	PP8 PP4 PP5	PP8 PP5 PP4	PP2 PP3 PP8	PP2 PP3 PP8	PP1 PP8
4K, 2K	N/A	PP7 PP4	PP4 PP5	N/A	PP2 PP3	N/A	PP1
1K	N/A	N/A	PP4 PP5	N/A	PP2 PP3	N/A	PP1

WARNING: Disconnect primary power prior to servicing.

Table 3-43 Maximum Data Symbols Per T2 Frame verses FFT Size and Guard Interval

FFT Size	Number of Data Symbols						
	1/128	1/32	1/16	19/256	1/8	19/128	1/4
32K	67	65	63	63	60	60	N/A
16K	137	134	130	128	122	120	110
8K	274	268	260	257	245	240	221
4K	N/A	536	520	N/A	491	N/A	442
2K	N/A	1073	1041	N/A	983	N/A	884
1K	N/A	N/A	2082	N/A	1966	N/A	1768

WARNING: Disconnect primary power prior to servicing.

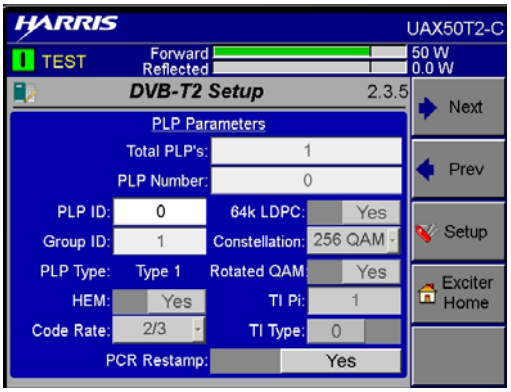


Figure 3-45 DVB-T2 Setup Screen 5

Table 3-44 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next x4 (screen 5)

Field	Explanation
Total PLP's	Total number of Physical Layer Pipes (PLP) sent in the T2 transmission. In MPEG-TS input mode there is only 1 PLP. In T2MI input mode there can be multiple PLPs from 1 to 255.
PLP Number	The number of an individual PLP for parameter entry/display. In MPEG-TS mode the PLP Number is 0 fixed. In T2MI mode the user can select PLP Number from 0 to 254.
PLP ID (Hex)	Enter value in white box. Range is 0 to 255. This 8-bit field uniquely identifies a PLP in the T2 system.
Group ID (Hex)	Enter value in white box. Range is 0 to 255. This 8-bit field identifies uniquely a PLP within the T2 system.
PLP Type	PLP (physical layer pipe) types include Type 1 (data), Type 2 (data).
HEM	Choices are Yes or No. The mode adaptation module can process input data in one of two modes, normal mode (NM) or high efficiency mode (HEM). NM is in line with the Mode Adaptation in [i.3], whereas in HEM, further stream specific optimizations may be performed to reduce signalling overhead. The BBHEADER (see clause 5.1.7) signals the input stream type and the processing mode.
Code Rate	Choices are 1/2, 3/5, 2/3, 3/4, 4/5, or 5/6.This refers to the forward error correction (FEC) which uses the LDPC (low density parity check) along with BCH code. 1/2 code rate provides the most robust performance coincident with the lowers data efficiency. 5/6 code rate provides the least robust performance coincident with the higher data efficiency. BCH performs the outer coding and LDPC performs the inner coding.

WARNING: Disconnect primary power prior to servicing.

Table 3-44 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator>Next x4 (screen 5)

Field	Explanation
64K LDPC	LPDPC (low density parity check), Yes indicates 64k LDPC is being used, No indicates that the 16k LDPC is being used. LDPC Parity Check (codes) are part of the inner coding forward error correction (FEC). Two types of FEC can be used with the associated PLP, they are the 16k LDPC or the 64k LDPC.
Constellation	Choices are QPSK, 16 QAM, 64 QAM, or 256 QAM. This is the main modulation mode for all subcarriers except for those of the L1 mode.
Rotated QAM	Choices are Yes or No. Yes is recommended state. The QAM constellations can be rotated off their normal axis up to 30 degrees in order to improve reception. Table 3-6 shows the rotation based on the constellation type. See Table 3-46 on page 73
TI PI	Enter value in white box. Range is 1 to 255. TI Pi is the number of T2 frames in an interleaving frame (when interleaver over multiple T2 frames, TI type = 1). TI Pi must be a factor of Ncells and must be less than or equal to the number of T2 frames per superframe.
TI Type	Choices are 0 or 1. If the TI Type is set to the value '1', than there is one interleaving frame which spans multiple T2-frames. The number of T2-frames is indicated by TI Pi. If the TI Type is set to the value '0', then one interleaving frame corresponds to one T2-frame and contains one or more time interleaver blocks.
PCR Restamp	Choices are Yes or No.PCR Restamp issued for transport interface. YES is required with transport input.
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

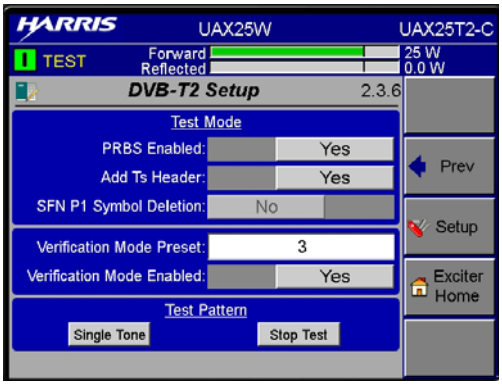


Figure 3-46 DVB-T2 Setup Screen 6

Table 3-45 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator (screen 6)

Field	Explanation
PRBS Enabled	Choices are Yes or No. When Yes is selected, the exciter will output RF without a transport stream input. When No is selected, the exciter will mute without a transport stream input.
Add TS Header	Choices are Yes or No. When Yes is selected, a valid transport stream header is pre-appended to each packet. When No is selected, a header is not added.
SFN P1 Symbol Deletion	Choices are Yes or No. Selecting yes clears the P1 symbol, which allows comparison of timing of different transmitters in a SFN.
Verification Mode Preset	Enter value in white box. These are pre defined setups winch can be applied by inputting the Verification Mode Preset number. Presently, usable Verification Mode Preset numbers are 1-17, and 19, these are SISO (single input single output modes), mode 18 is MIMO (multiple input single output). Table 3-47 on page 73 through Table 3-49 on page 75 provide the parameters for the 19 Verification Mode Presets.
Verification Mode Enabled	Choices are Yes or No. Entering Yes activates the Verification Mode Preset entry. This deactivates the various effected entries in the other DVB-T2 setup screens. Entering No deactivates the Verification Mode Preset entry and activates the various effected entries in the other DVB-T2 setup screens.
Single Tone	Pressing the Single Tone soft key in the test pattern sub window causes a single tone, placed at the center of the spectrum, to be transmitted. It is used to measure the channel carrier frequency. The single tone signal is the same power as the exciter is putting out normally.
Stop Test	Normal transmission is resumed by pressing the Stop Test soft key.

WARNING: Disconnect primary power prior to servicing.

Table 3-45 Xmtr Home>Exciter Home>Setup>DVB-T2 Modulator (screen 6)

Field	Explanation
Softkeys	
Setup	Displays Setup screen.
Exciter Home	Displays Exciter Home screen.

Table 3-46 Constellation Type and Rotation

Modulation	QPSK	16-QAM	64-QAM	256-QAM
Phase Rotation (degrees)	29.0	16.8	8.6	3.576

Table 3-47 Verification Mode Preset, Numbers 1-7

Verification Mode Preset Number	001	002	003	004	005	006	007
VV Reference	CR35	CR35L	CR23	8KFFT	8KFFT	16KFFT	16KFFT
Rate	3/5	3/5	2/3	3/4	3/5	5/6	2/3
FEC Type	64800	64800	64800	64800	64800	64800	64800
Mode	HEM	HEM	HEM	HEM	HEM	HEM	HEM
Rotated QAM	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Modulation	256QAM	256QAM	256QAM	64QAM	256QAM	64QAM	16QAM
L1 Modulation	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
FFTSIZE	32K	32K	32K	8K	8K	16K	16K
GI	1/128	1/128	1/128	19/256	1/16	1/4	19/128
Pilot Pattern	PP7	PP7	PP7	PP5	PP8	PP1	PP8
Extended Carrier Mode	Yes	Yes	Yes	Yes	Yes	No	Yes
SISO/MISO	SISO	SISO	SISO	SISO	SISO	SISO	SISO
PAPR	None	None	None	None	None	None	None
Data Symbols	59	59	59	81	59	22	59

WARNING: Disconnect primary power prior to servicing.

Table 3-47 Verification Mode Preset, Numbers 1-7

Verification Mode Preset Number	001	002	003	004	005	006	007
VV Reference	CR35	CR35L	CR23	8KFFT	8KFFT	16KFFT	16KFFT
TiPi	1	1	1	1	1	2	1
Ti Type	0	0	0	0	0	1	0
Bit Rate (Mbps)	36.14	36.14	40.21	30.32	33.29	26.11	17.46

Table 3-48 Verification Mode Preset, Numbers 8-14

Verification Mode Preset Number	008	009	010	011	012	013	014
VV Reference	16KFFT	4KFFT	2KFFT	1KFFT	64QAM 45	64QAM 56	64QAM 34
Rate	4/5	2/3	3/5	1/2	4/5	5/6	3/4
FEC Type	64800	64800	64800	64800	64800	64800	64800
Mode	Normal	Normal	Normal	Normal	HEM	HEM	HEM
Rotated QAM	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Modulation	256QAM	64QAM	16QAM	QPSK	64QAM	64QAM	64QAM
L1 Modulation	64QAM	16QAM	QPSK	BPSK	64QAM	64QAM	64QAM
FFTSIZE	16K	4K	2K	1K	8K	8K	8K
GI	1/32	1/32	1/8	1/8	1/32	1/32	1/32
Pilot Pattern	PP6	PP7	PP2	PP3	PP7	PP7	PP7
Extended Carrier Mode	Yes	No	No	No	Yes	Yes	Yes
SISO/MISO	SISO	SISO	SISO	SISO	SISO	SISO	SISO
PAPR	None	None	None	None	TR	TR	TR
Data Symbols	100	100	983	1966	242	242	242
TiPi	1	1	1	1	1	1	1
Ti Type	0	0	0	0	0	0	0
Bit Rate (Mbps)	46.36	27.59	14.36	6.17	34.69	36.16	32.51

WARNING: Disconnect primary power prior to servicing.

Table 3-49 Verification Mode Preset, Numbers 15-19

Verification Mode Preset Number	**015**	**016**	**017**	**018**	**019**
VV Reference	**8KFFT**	**256QAM34**	**PAPRTR**	**MISO**	**NOROT**
Rate	3/5	3/4	4/5	5/6	3/5
FEC Type	64800	64800	64800	64800	64800
Mode	HEM	HEM	HEM	HEM	HEM
Rotated QAM	Yes	Yes	Yes	Yes	No
Modulation	256QAM	256QAM	256QAM	256QAM	256QAM
L1 Modulation	64QAM	64QAM	64QAM	64QAM	64QAM
FFTSIZE	8K	32K	32K	32K	32K
GI	1/32	1/128	1/32	1/16	1/128
Pilot Pattern	PP7	PP7	PP4	PP2	PP7
Extended Carrier Mode	Yes	Yes	Yes	Yes	Yes
SISO/MISO	SISO	SISO	SISO	MISO	SISO
PAPR	None	TR	TR	None	None
Data Symbols	238	59	19	19	59
TiPi	1	1	1	1	1
Ti Type	0	0	0	0	0
Bit Rate (Mbps)	34.97	44.79	44.75	43.16	36.14

WARNING: Disconnect primary power prior to servicing.

3.10 Setup Screens - DAB Modulation

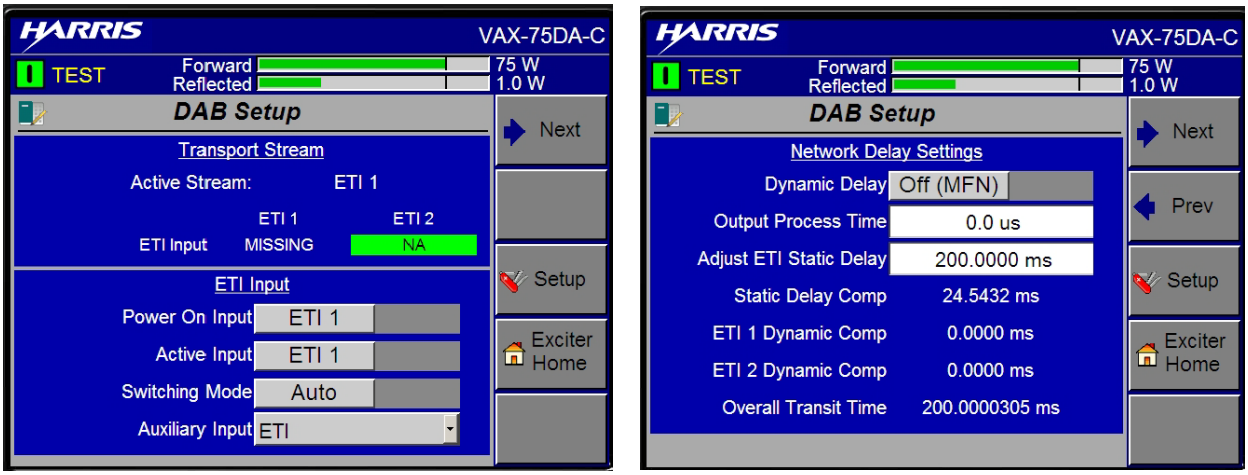


Figure 3-47 DAB Setup Screens 1 & 2

Table 3-50 Xmtr Home>Exciter Home>Setup>DAB Modulator & >Next

Field	Explanation
Transport Stream	
Active Stream	Indication of currently active transport stream
ETI Input	Availability status of ETI 1 and ETI 2 Transport Streams. Indicates the ETI mode. NI for G.703, NA for G.704. Shows MISSING when no ETI input is present.
ETI Input	
Power on Input	The choices are ETI 1 or ETI 2. This determines which input will be selected on power-up.
Active Input	The selected input, ETI 1 or ETI 2, is the active input. This determines which input is currently the source of data for modulation.
Switching Mode	Choices are Automatic or Manual switching of the ETI Transport stream. If the ETI switching mode is in Automatic and the current ETI stream has an issue, or drops out, the system will switch to the Auxiliary ETI stream if it is available and good. The LPU will switch to the Auxiliary input only if Auxiliary Input (set below) is set to Yes.
Auxiliary Input	No/Yes. If Auxiliary Input is set to Yes, Switching Mode, if Automatic, will switch to this input on loss of signal on Primary input.
Network Delay Settings	

WARNING: Disconnect primary power prior to servicing.

Table 3-50 Xmtr Home>Exciter Home>Setup>DAB Modulator & >Next

Field	Explanation
Dynamic Delay	Select Off (MFN) (Multi Frequency Network) or On (SFN) (Single Frequency Network). - MFN mode selects operation in a Multiple Frequency Network (transmitters on different frequencies) which does not require synchronization with the other transmitters in a network. - SFN mode selects operation in Single Frequency Network (transmitters on same frequency) which requires synchronization with other transmitters in a network. - If SFN is selected a GPS antenna is utilized. The PFRU set up specifies Internal GPS. See Section 3.4.5 on page 3-33. 1PPS may also be used for SFN synchronization in some applications. This applies to every modulation mode that supports SFN.
Output Process Time	Enter a value in microseconds (µS). Time settings are used to synchronize the transmission timing for single frequency networks. Output process time is the additional time delay of equipment after the LPU in the RF transmission path. It controls setting of RF and antenna delay. Non volatile setting of 0-100µS causes exciter output to be emitted sooner. This additional delay is needed so that the transit time (through the transmitter power amplifier, high power filter, and transmission line) can be included in the LPU delay.
Adjust ETI Static Delay	Enter a value in milliseconds (mS). ETI static delay is additional time entered to delay LPU emission in MFN mode. In static delay mode this non-volatile setting controls the overall exciter signal delay. Range T_{min} to 999.9999 mS. T_{min} varies by DAB mode and can be seen by entering 0. In dynamic delay mode this non-volatile setting provides local offset delay. Range is T_{min} to 999.9999mS.
Static Delay Compensation	Amount of delay above the minimum required to meet the Adjust Static Delay time.
ETI 1 Dynamic Comp	Adjustable signal delay used to balance out the different transit times of the transmitters in a single frequency network (compensation delay), plus and individual delay to optimize SFN signal coverage (offset delay) when necessary.
ETI 2 Dynamic Comp	See above.
Overall Transit Time	The signal processing time (static delay), the compensation delay, and the offset delay are added together, and the total is displayed here. Output process time does not affect overall transit time since this is more of a calibration factor for the system from the exciter output thru the antenna.

WARNING: Disconnect primary power prior to servicing.

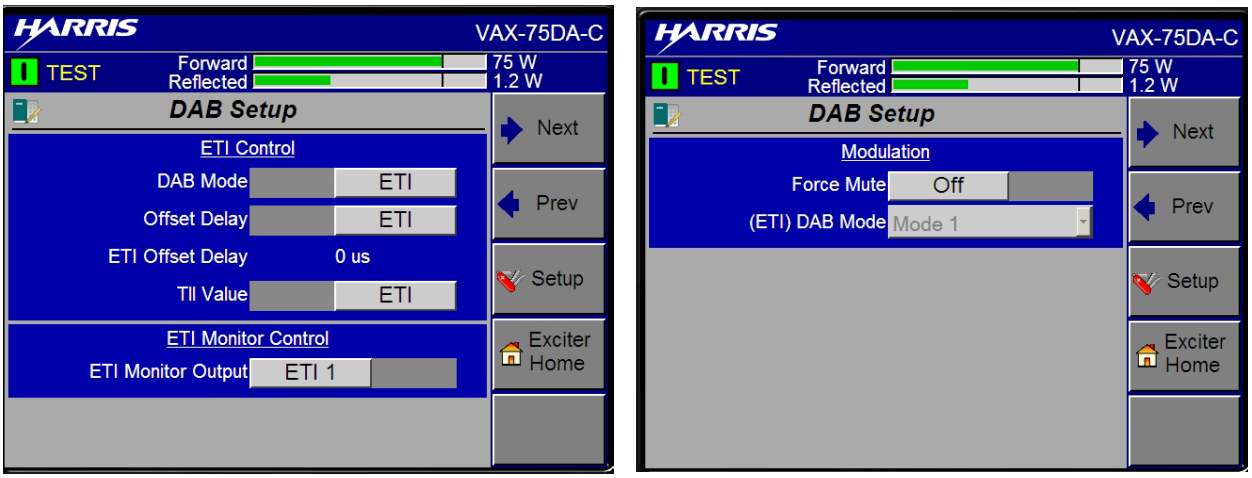


Figure 3-48 DAB Setup Screens 3 & 4

Table 3-51 Xmtr Home>Exciter Home>Setup>DAB Modulator>Next x3

Field	Explanation
ETI Control: These MNSC controls determine if the Mode, Offset Delay, and TII Value are set locally or by the MNSC.	
DAB Mode	ETI/Local. If ETI is selected control is via the MNSC.
Offset Delay	ETI/OFF Allows the offset delay to be controlled via the ETI stream if ETI is selected.
ETI Offset delay	Displays MNSC ETI offset from selected ETI input. Displays 0 us if ETI Offset control is OFF.
TII Value	ETI/Local. Controls whether the transmitter identification main and sub-identifier values are set locally or are received via the MNSC.
ETI Monitor Control	
ETI Monitor Output	ETI 1/ETI 2. Set which ETI input is multiplexed to the ETI Monitor output.
Modulation	
Force Mute	Off/On. Allows muting of exciter.
(ETI) DAB Mode	When MNSC DAB Mode is set to Local this setting controls the DAB modulator mode. If the ETI Control DAB Mode setting is ETI then this field displays the current mode commanded via the MNSC setting or ETI control via the MNSC. If the ETI Control DAB Mode setting is Local then this field controls the current DAB mode. Values are Mode 1, Mode 2, Mode 3, or Mode 4.

WARNING: Disconnect primary power prior to servicing.

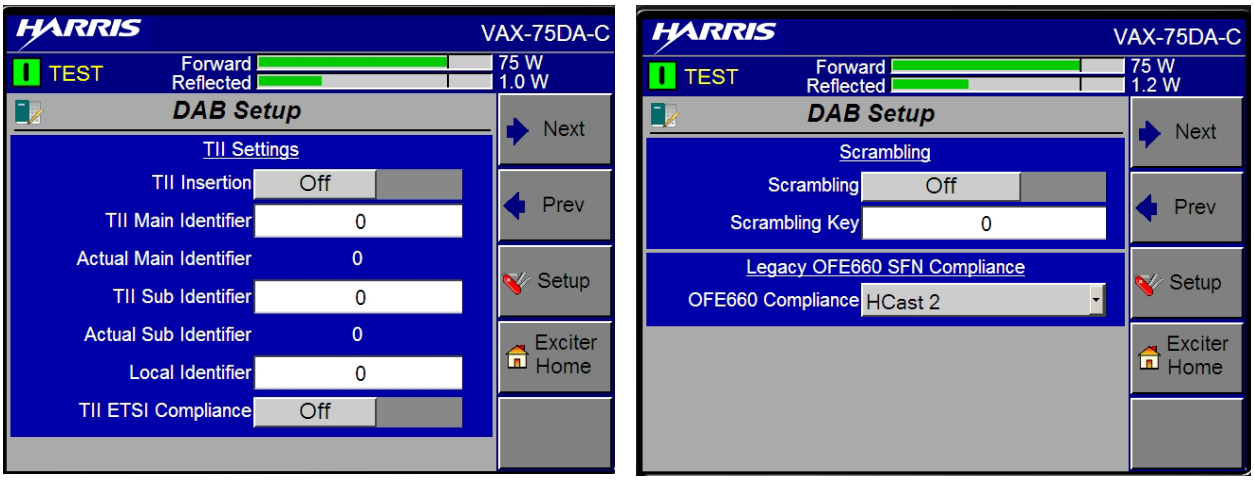


Figure 3-49 DAB Setup Screens 5 & 6

Table 3-52 Xmtr Home>Exciter Home>Setup>DAB Modulator>Next x4

Field	Explanation
TII Settings	
TII Insertion	Off/On. Enables/Disables Transmitter Identifier Information (TII). Main identifier and sub-identifier.
TII Main Identifier	Local TII Main Identifier. Range is 0 – 63. When MNSC TII value is set to Local this setting determines the TII main identifier.
Actual Main Identifier	When MNSC TII value is set to ETI this status displays the main identifier being broadcast.
TII Sub Identifier	Local TII Sub Identifier. Range is 0 – 23. When MNSC TII value is set to Local this setting determines the TII sub-identifier.
Actual Sub Identifier	When MNSC TII value is set to ETI the actual TII sub-identifier being broadcast is displayed here.
Local Identifier	Sets the transmitter ID used as an identifier for the MNSC. In this instance messages addressed to 17 will be decoded.
Scrambling	
Scrambling	Off/On. Enables/Disables scrambling.
Scrambling Key	De-scrambling key entry. Range is 0 to 255.
Legacy OFE660 SFN Compliance	
OFE660 Compliance	On/ Off. Controls setting of M2X SFN compatibility mode. Allows SFN compatibility with legacy systems. Off is the default setting.

WARNING: Disconnect primary power prior to servicing.

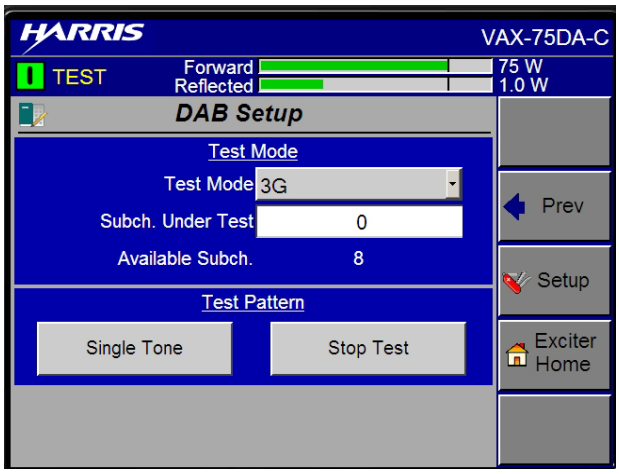


Figure 3-50 DAB Setup Screen 7

Table 3-53 Xmtr Home>Exciter Home>Setup>DAB Modulator>Next x5

Field	Explanation
Test Mode	
Test Mode	Off/On. Controls the DAB test modes. Off disables all DAB test modes. 3G Test Mode provides a full payload of PRBS. Provides a test signal for on-air signal generation. Online Test Mode allows injection of PRBS into a DAB subchannel. (Requires an ETI input.).
Subch. Under Test	If Online Test Mode is on this controls channel that PRBS data is injected into.
Available Subch.	Displays the number of subchannels available.
Test Pattern	
	Choose: Single Tone or Stop Test

WARNING: Disconnect primary power prior to servicing.

3.11 Status Screens, All Modulation Systems

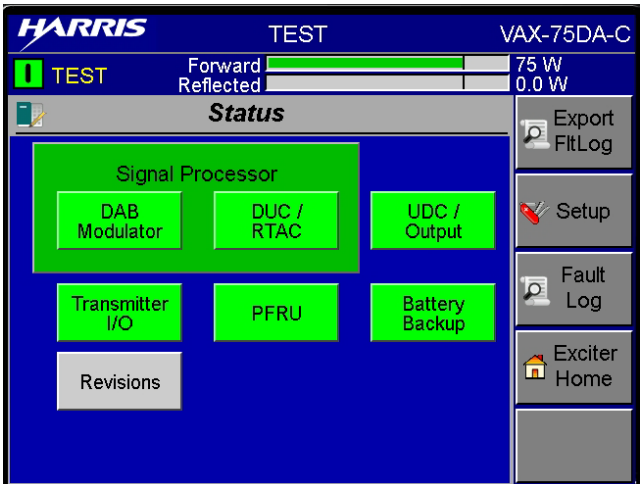


Figure 3-51 Status Screen

Table 3-54 Xmtr Home>Exciter Home>Status

Field	Explanation
Signal Processor	See 3.11.1 on page 3-82.
UDC/ Output	See 3.11.2 on page 3-84.
Transmitter I/O	Only available for select modulations. See 3.11.3 on page 3-85.
PFRU	See 3.11.4 on page 3-87.
Battery Backup	See 3.11.5 on page 3-90
Revisions	See 3.11.6 on page 3-91.
Softkeys	
Export Fault Log	Save fault log to file for export. Use File>Save Page to save HTML or text.
Setup	Displays Setup screen.
Fault Log	Displays Fault Log.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.11.1 Signal Processor Status Screens

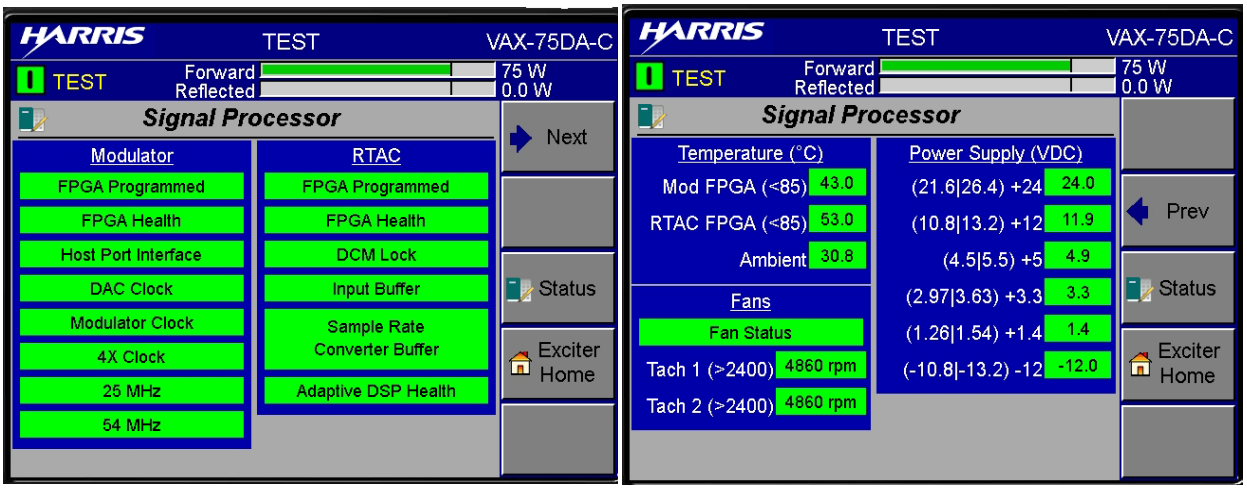


Figure 3-52 Signal Processor Status Screen (1 & 2)

Table 3-55 Status >Signal Processor (1 & 2)

Field	Explanation
Modulator Sub Window	
FPGA Programmed	Green = FPGA is programmed. Red = fault
FPGA Health	Green = serial communication with Modulator FPGA is OK. Red = fault
Host Port Interface	Green = communication through the Modulator Host Port is OK. Red = fault
DAC Clock	Green = DAC clock is detected and deemed correct. Red = fault
Modulator Clock	Modulator clock is detected and deemed correct. Red = fault
4X Clock	Modulator 4X clock is detected and deemed correct. Red = fault
25MHz	Green = 25MHz clock is detected and deemed correct. Red = Fault
54MHz	Green = 54MHz Clock is detected and deemed correct. Red = Fault
RTAC Sub Window	
FPGA Programmed	Green = DUC FPGA is programmed. Red = fault
FPGA Health	Green = serial communication with DUC FPGA is OK. Red = fault
DCM Lock	(Digital Clock Manager) Green = DUC FPGA DCM is locked. Red = fault
Input Buffer	Green = Input Buffer is OK. Red = overflow or underflow
Sample Rate Converter Buffer	Green = Sample Rate Converter Buffer OK. Red = overflow or underflow
Adaptive DSP Health	Green = Controller is communicating with the Adaptive DSP. Red = fault
Temperature (°C)	

WARNING: Disconnect primary power prior to servicing.

Table 3-55 Status >Signal Processor (1 & 2)

Modulator FPGA	Warning temperature is 80 degrees C. Maximum temperature is 85 degrees C. If the temperature rises above 85 degrees C for a period of three or more seconds, both the Modulator and RTAC FPGAs de-program to protect the exciter from damage. Warning = yellow and Fault = red.
RTAC FPGA	Warning temperature is 80 degrees C. Maximum temperature is 85 degrees C. If the temperature rises above 85 degrees C for a period of three or more seconds, both the Modulator and RTAC FPGAs de-program to protect the exciter from damage.
Ambient	Ambient exciter temperature. Normal temperature range is between -30 degrees C and 50 degrees C. Warning temperature is 80 degrees C.
Fans	
Fan Status	The Fan Status field provides the summary fan status of the two front panel fans. If both fans are OK, the Fan Status field is Green. If either fan has a warning, or one fan is faulted, the Fan Status field is Yellow. If both fans are faulted, the Fan Status field is Red. The exciter will operate on only one fan.
Tach 1	Tach 1 and Tach 2 fields provide readouts of the two exciter fan speeds. The value within the parenthesis is the minimum allowable fan speed. The Tach 1 and Tach 2 fields are color coded as follows: OK = Green, Warning = Yellow, Fault = Red. Refer to Table 3-56 on page 3-83 for fan speed status:
Tach 2	(See Tach 1)
Power Supply (VDC)	The values given in the parenthesis provide minimum and maximum voltage limits, with the nominal supply voltage given next. If the indicated voltage in the right hand window is within range (10% of nominal), its background will be Green.
Softkeys	
Status	Displays the Status screen.
Exciter Home	Pressing this soft key displays Exciter Home Screen, *on right* Figure 3-12 on page 3-17.

NOTE:
If temperatures are below the maximum value (given in parenthesis) the indicator background will be Green. If above the maximum value, background will be Red.

Table 3-56 Fans Tach 1 and Tach 2

Fan Speed (rpm)	Status
<= 2400	Fault
2401 – 2880	Warning
2881 – 46079	OK
>= 46080	Warning (Check Fan Filter)

The **Tach 1** and **Tach 2** fields are color coded as follows: OK = Green, Warning = Yellow, Fault = Red.

3.11.2 DUC/RTAC or UDC Output Status Screen

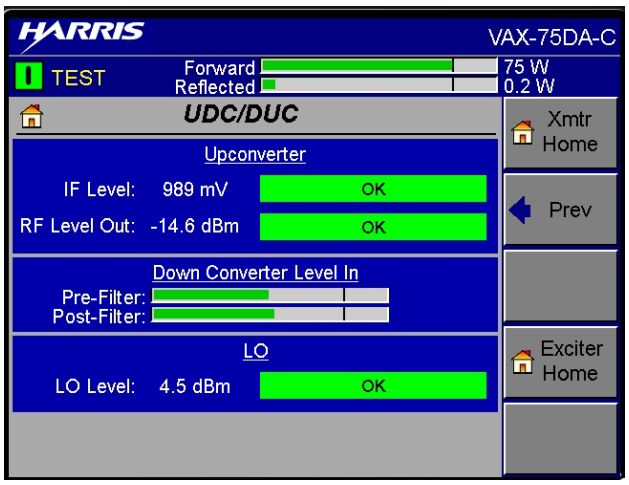


Figure 3-53 Status DUC/RTAC or UDC/Output

Table 3-57 Xmtr Home>Exciter Home>Status>DUC/RTAC or UDC/Output

Field	Explanation
Upconverter Sub Window	
IF Level	Green indication background is OK, red = fault. IF Level (in mV), range is 900 to 1100.
RF Level Cut	Green = UDC is communicating, Red = fault
Downconverter Level In	
Pre-Filter	This is a bargraph indication which gives the relative pre- filter RTAC RF sample level. The maximum signal level span is -20dBm to +5dBm, but, if possible, it is better to attempt to keep the RF sample levels between -10 dBm and 0 dBm. Since the sample levels at the sample cable outputs are usually too high, the level is adjusted by adding appropriate attenuation at the exciter sample input connectors.
Post-Filter	This is a bargraph indication which gives the relative post- filter RTAC RF sample level. The maximum signal level span is -20dBm to +5dBm, but, if possible, it is better to attempt to keep the RF sample levels between -10 dBm and 0 dBm. Since the sample levels at the sample cable outputs are usually too high, the level is adjusted by adding appropriate attenuation at the exciter sample input connectors.
LO Sub Window	
LO LevelF	Green indication background is OK, red = fault. LO Level (in mV), range is 2222 to 2427.

WARNING: Disconnect primary power prior to servicing.

Table 3-57 Xmtr Home>Exciter Home>Status>DUC/RTAC or UDC/Output

Field	Explanation
Softkeys	
Xmtr Home	Displays the Xmtr Home screen.
Exciter Home	Pressing this soft key displays Exciter Home Screen, *on right* Figure 3-12 on page 3-17.

3.11.3 Transmitter I/O Status screen

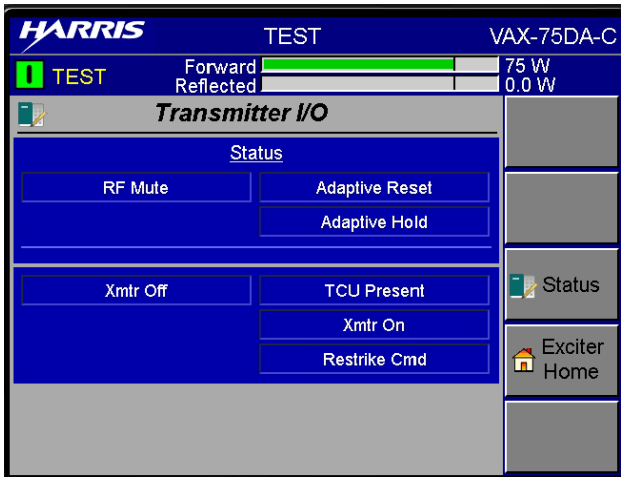


Figure 3-54 Status TX I/O Screen

Table 3-58 Xmtr Home> Exciter Home> Status >Transmitter I/O

Field	Explanation
Status Sub Window	
Power Raise	Green is active, blue is inactive, input on pin 1
Power Lower	Green is active, blue is inactive, input on pin 2
RF Mute	Green is active, Blue is inactive - input on pin 6
Adaptive Reset	Resets adaptive correction tables to default values. Green is active, Blue is inactive - input on pin 10
Adaptive Hold	Holds current adaptive correction tables. Green is active, Blue is inactive - input on pin 11

WARNING: Disconnect primary power prior to servicing.

Table 3-58 Xmtr Home> Exciter Home> Status >Transmitter I/O

Field	Explanation
Foldback Input Voltage	The Foldback Input Voltage shown in this screen is a DC voltage which is proportional to the reflected power returning to the transmitter output (the transmitter VSWR). Excessive reflected power coming back to the transmitter will cause the exciter RF output power to reduce. This is referred to as VSWR foldback.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

NOTE:
The indicators in this screen display the status of the input commands described in Table 3-58 on page 3-85. These inputs enter the transmitter via the 25 pin male Transmitter Interface connector on the transmitter I/O Board. The connector pin numbers are given on Revisions Status Screens

WARNING: Disconnect primary power prior to servicing.

3.11.4 PFRU Status Screens

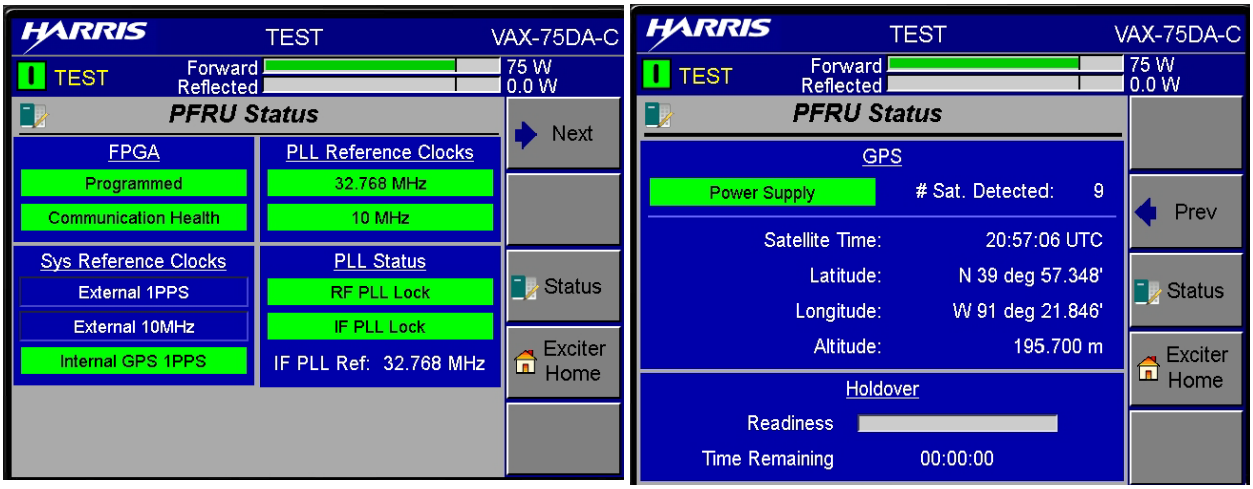


Figure 3-55 PFRU Status Screens 1 & 2

Table 3-59 Xmtr Home> Exciter Home> Status >PFRU Status

Field	Explanation
FPGA	(Field Programmable Gate Array)
Programmed	Green = PFRU is programmed, Red = fault
Communication Health	Green = Serial communication OK with PFRU FPGA, Red =fault
Sys Reference Clocks	
External 1PPS	When selected as the 10MHz OCXO Reference, Present = Green background, Missing = Yellow. A Blue background indicates this source is not selected as the 10MHz OCXO Reference. This input is derived from the customer's GPS receiver.
External 10MHz	When selected as the 10MHz OCXO Reference, Present = Green background, Missing = Yellow. A Blue background indicates this source is not selected as the 10MHz OCXO Reference. This input can be derived from a variety of sources. See Table 3-17 on page 36 for more info.
Internal GPS 1PPS	When selected as the 10MHz OCXO Reference, Present = Green background, Missing = Yellow. A Blue background indicates this source is not selected as the 10MHz OCXO Reference. This signal is derived from the transmitter's internal GPS receiver.
PLL Reference Clocks	

WARNING: Disconnect primary power prior to servicing.

Table 3-59 Xmtr Home> Exciter Home> Status >PFRU Status

32.768MHz (DAB modulation)	Green = OK, Red = fault. The 32.768MHz Clock originates on the DAB Input Option board and is routed to the Precision Frequency Reference Unit (PFRU) where it is used as the IF PLL Reference. The IF PLL output of the PFRU (labeled DAC Clock on the PFRU) is used on the Signal Processing Board to produce clocks for the IF DAC and IF ADC, as well as other various system clocks. An IF PLL Reference frequency of 32.768MHz is used for DAB modulation.
54 MHz	Green = OK, Red = fault. This is an internal clock used to synchronize the RF PLL in the Precise Frequency Reference Unit (PFRU). Non-DAB modulation formats will use either a 10MHz or 54MHz reference for the IF PLL
10 MHz	Green = OK, Red = fault. This is an internal clock used to synchronize the RF PLL in the Precise Frequency Reference Unit (PFRU). Non-DAB modulation formats will use either a 10MHz or 54MHz reference for the IF PLL
PLL Status	(LO) is Local Oscillator.
RF (LO) PLL Lock	Green = OK, Red = fault. This reference output from this circuit is used by the up converter to set the exciter output to the correct frequency and is used by the down converter to heterodyne the RF output samples back to the IF frequency.
IF (LO) PLL Lock	Green = OK, Red = fault. This PLL output is used as a reference by the FPGA Modulator, Digital Precorrector, and Digital to Analog Converter (DAC) to generate the to produce the 140 MHz analog IF output from the signal processor board.
IF PLL Ref	This indicates the reference frequency used by the IF local oscillator.
GPS	
Power Supply	Green = OK, Red = fault
# Sat. Detected	The transmitter needs to detect a minimum of three satellites for GPS lock and possible range.
Satellite Time	Clock time-of-day
Latitude	N yy degrees yy.yyy minutes
Longitude	W yy degrees yy.yyy minutes
Altitude	yyyy.yyy meters
NOTE: Time, Latitude, Longitude, and Altitude indications appear when the internal GPS receiver is locked to three or more satellites.	

Table 3-59 Xmtr Home> Exciter Home> Status >PFRU Status

Readiness (Holdover Readiness bar graph)	Green if the graph indicates 90% or higher, red if below 90%, and gray if the 1 PPS reference is lost. This indicates the lock status of the OCXO (Oven Controlled crystal (X) Oscillator). If the graph is Green, the 10MHz OCXO PLL is locked to the 1PPS reference and is capable of holdover (free running) for 24 hours. This means that the oscillator frequency will remain within tolerance and allow transmitter operation for 24 hours without being synchronized to its reference. OCXO Holdover Readiness bargraph percentage represents the difference between the maximum and minimum oscillator control value over a 20 minute window, and is the indication of how well disciplined the oscillator is. If the holdover status value is above 90%, then the oscillator is only changing +/- 0.0003 Hz, and is good enough to use. The value will never reach 100%, but when well disciplined should be 90% or greater. The 10MHz OCXO is divided down to a 1Hz frequency and locked, via a phase locked loop, to a GPS 1PPS (Pulse Per Second) reference signal. The purpose is to create a synthesized 1PPS signal which is used as a timing signal, for example, to synchronize a single frequency network. The 10 MHz OCXO signal is also used as a reference for the local oscillator, which determines the RF output frequency of the exciter. The synthesized 1PPS signal will be present even when the GPS 1PPS reference is missing. In that case, the 10 MHz OCXO holdover oscillator will be free running.
Time Remaining	When the 1PPS reference is lost, the OCXO Holdover Readiness graph turns gray, and the 10 MHz OCXO is free running. The Holdover Time Remaining indication starts to count down from 24 hours. When its time reaches zero, the transmitter will mute if it is in the SFN mode When the reference is restored and the oscillator starts to lock, the OCXO Holdover Readiness graph indication will start to increase. While it is below 90%, the graph is Red. The exciter, if in the SFN mode, will be muted. When the graph reaches 90% or higher, it will turn Green, and the exciter, if in the SFN mode, will unmute.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.11.5 Battery Backup Status Screen

The battery backup is active when the battery is charged. This includes shipment and storage (unless the battery backup is disabled via an external jumper). When the battery backup voltage decreases to approximately 86.5% of its nominal voltage, the battery backup is disabled. When AC power is again applied to the VAX-C, the backup battery recharge time is two to three hours.

The Battery Backup screen gives status and information on the exciter battery backup board. Descriptions of the various battery backup screen indications are given in the following tables. More detailed descriptions of the battery back up option functionality can be found in Section 4.4.5, Battery Backup Option, on page 4-9.

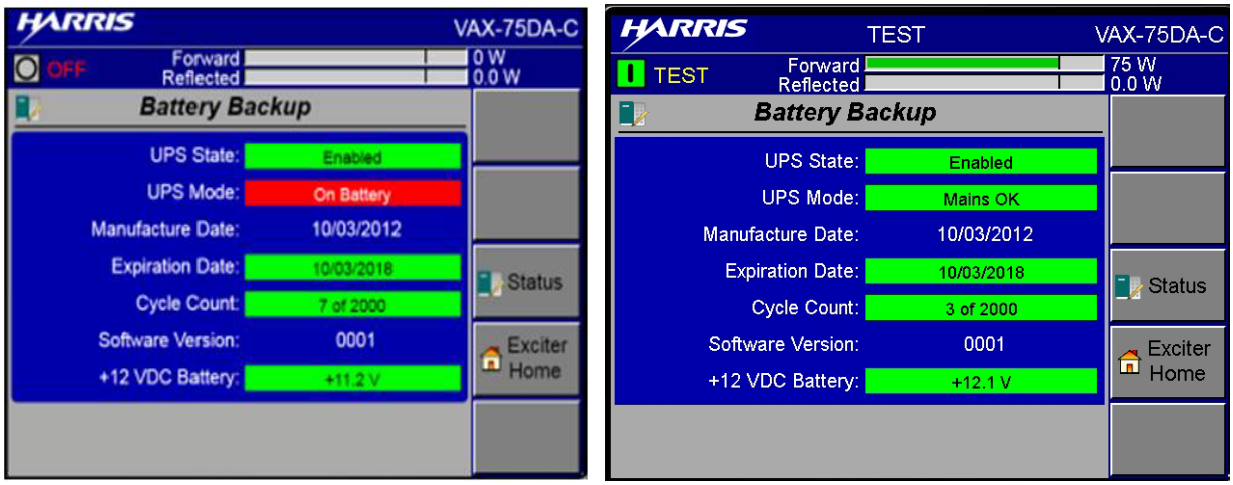


Figure 3-56 Battery Backup Status Screen

Table 3-60 Xmtr Home> Exciter Home> Status > Battery Backup

Field	Explanation
UPS State	Status is Enabled or Disabled. This is an input from the transmitter I/O. It is used to disable the backup battery. The input for this control is pin 9 of the Transmitter Interface Connector, which is found on the transmitter I/O board option. The battery backup can be disabled by addition of a connector/jumper described in Figure 2-6 on page 2-19.
UPS Mode	Indicates either On Battery or Mains OK.
Manufacture Date	Date battery was released by manufacturer.
Expiration Date	Battery is considered expired if this six year expiration date has passed.
Cycle Count	Number of charge/discharge cycles. Replace battery when 2000 count is reached.

WARNING: Disconnect primary power prior to servicing.

Table 3-60 Xmtr Home> Exciter Home> Status > Battery Backup

Field	Explanation
Software Version	Software version read from chip on battery pack.
+12VDC Battery	A fault occurs if the +12 volt output drops to +10 volts. ***Note:*** The +9.6 volt output of the backup battery is converted to +12 VDC. The fault occurs when the +9.6 VDC drops to 8.3 VDC
Softkeys	
Status	Opens Status screen as shown in Figure 3-51 on page 3-81
Exciter Home	Pressing this soft key displays Exciter Home Screen, *on right* Figure 3-12 on page 3-17.

3.11.6 Revisions Status Screens (1 & 2)

System software revisions information is displayed on Revision Status Screens 1 & 2 below. Select Next to display Hardware Revisions screen. The most important field is the Build Version. The Build revision indicates the software build that is currently running on the system. If the build revision reads Customer Special then the system is running a non-released or incomplete build.

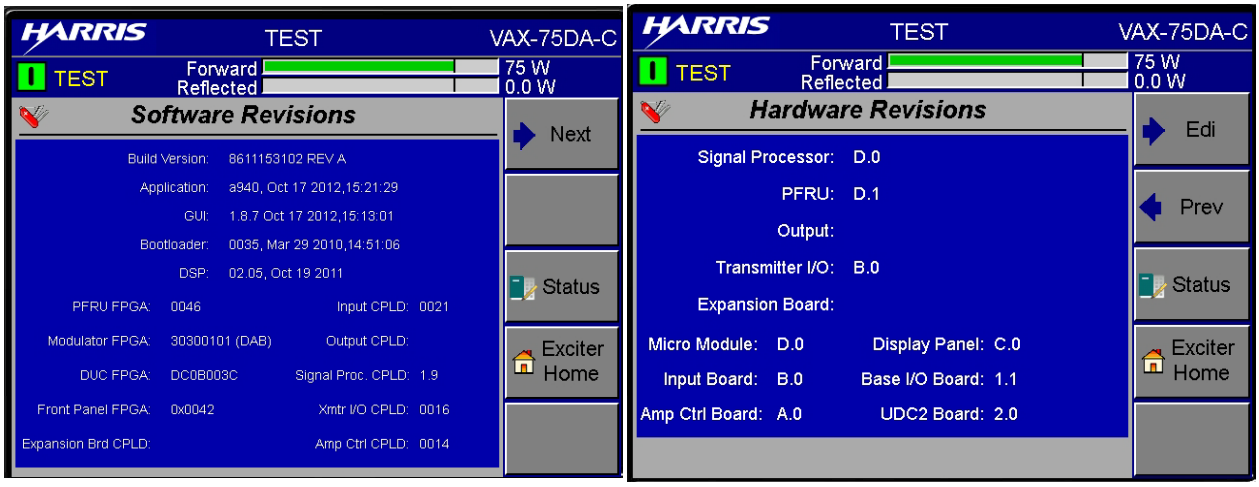


Figure 3-57 Revisions Status Screens (1 & 2)

WARNING: Disconnect primary power prior to servicing.

3.12 Status Screens - ATSC Modulation

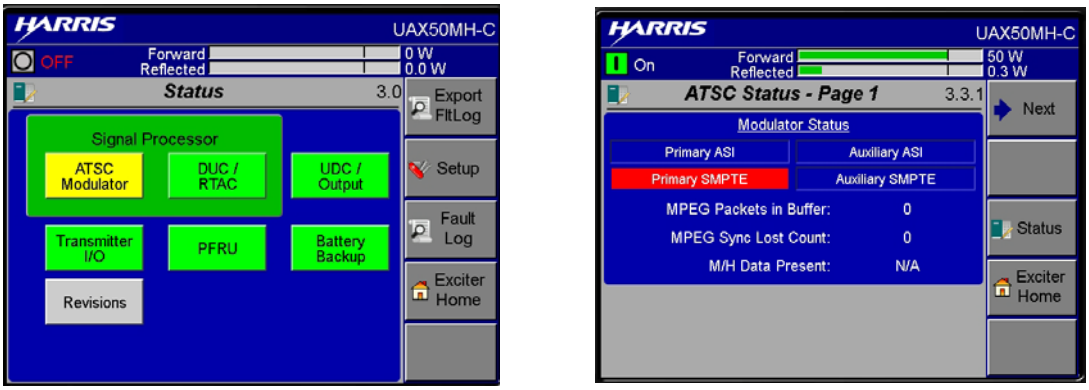


Figure 3-58 ATSC Main Status Screen *(right)*-ATSC Modulator Status Screen 1 (left)

Figure 3-59 Xmtr Home>Exciter Home>Status>ATSC Modulator (screen 1)

Field	Explanation
Primary ASI	Green if present. Red if faulted or absent. If transport stream input is present, but are not selected for transmission, its indicators will be yellow. Typically, only two inputs used at a time. See Section 2.7.4 to determine which two inputs will be used.
Primary SMPTE	
Auxiliary ASI	
Auxiliary SMPTE	
MPEG Packets in Buffer	Incoming MPEG data is stored in a FIFO buffer. For MFN operation, the usual FIFO mid-buffer depth is 1304 packets. In SFN operation, the number of packets held in the buffer is dependent on the emission timing requirements. In either case, the number of packets in the buffer should be relatively stable.
MPEG Sync Lost Count	Number of times the exciter's input circuit has lost synchronization with the incoming MPEG sync to the extent that the circuit had errors and had to reacquire.
M/H Data Present	Yes or No. If the exciter has MDTV mode enabled, this will indicate whether or not mobile DTV is indeed present in the transport stream.
Softkeys	
Export Fault Log	Save fault log to file for export. Use File>Save Page to save HTML or text.
Setup	Displays Setup screen.
Fault Log	Displays Fault Log.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

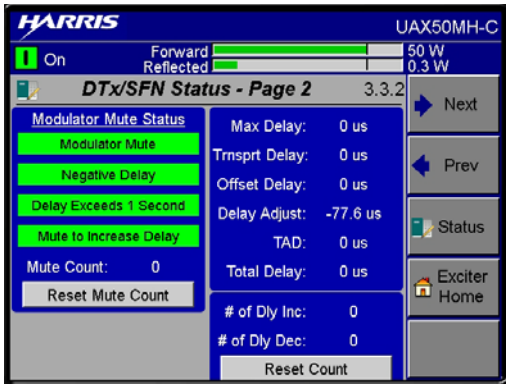


Figure 3-60 ATSC Modulator Status Screen (Page) 2

Figure 3-61 Xmtr Home>Exciter Home>Status>ATSC Modulator>Next (screen 2)

Field	Explanation
Modulator Mute	Green = OK, Red = Mute. If the digital modulator section is actively muted, this will indicate red.
Negative Delay	In SFN situations, the exciter can only insert (add) delay. If the timing parameters are improperly set at the transmission adapter or a network change (such as a substituting a satellite path for a microwave path to get the transport stream to the exciter) the exciter may determine that based on the resultant timing, the result indicates that it must remove delay to actually meet the emission timing. This simply isn't possible and will be indicated.
Delay Exceeds 1 Second	Green = Delay < 1 second, red = delay > 1 second. Transmitter delay, for SFN (single frequency network) data transmission synchronism, is measured against the 1PPS (pulse per second) pulse. If transmitter delay exceeds 1 second, SFN data transmission synchronism is impossible.
Mute to Increase Delay	Modulator has determined that it can no longer meet the required timing and it must mute it's output to re-sync and increase the delay inserted
Mute Count	This is the number of times the digital modulator has been muted.
Reset Mute Count Soft Key	Pressing this soft key resets the mute count to zero.
Max Delay	This is a read back of the maximum delay parameter being carried inside the Distributed Transmission Packet. It should match the value set in the Distributed Transmission Adapter. This value is indicative of the maximum transport delay the network designer / operator expects to see. It's maximum value is 100 nS less than 1 second.
Transport Delay	This is the time from when a packet is released inside the transmission adapter until the time it arrives in the modulator. It also includes a nominal amount of internal FIFO buffer hold time.

WARNING: Disconnect primary power prior to servicing.

Figure 3-61 Xmtr Home>Exciter Home>Status>ATSC Modulator>Next (screen 2)

Field	Explanation
Offset Delay	Time offset for emission contained in the Distributed Transmission Packet for this particular transmitter.
Delay Adjust	This is a dynamic indication of the amount of delay adjustment the modulator is computing. Nominally this should be zero. It often moves plus or minus 100 nS for minor adjustments. Important that it is relatively stable, not wildly fluctuating.
TAD	Transmitter to antenna delay. This the throughput delay, measured after the signal leaves the exciter network delay circuit and travels to the output of the transmitter. This delay is important if the network consists of transmitters from different manufactures, where the output process time will change from one manufacturer to another.
Total Delay	This is the resultant total delay being managed by the timing requirements to meet the emission time, including TAD.
# of Dly Inc	Number of delay increments that the modulator has had to perform to maintain emission timing. High or continual incrementing numbers here indicate instability in the network's distribution of the transport stream or timing. Ideally this is zero.
# of Dly Dec	Number of delay decrements that the modulator has had to perform to maintain emission timing. High or continual incrementing numbers here indicate instability in the network's distribution of the transport stream or timing. Ideally this is zero.
Reset Count Soft Key	Pressing this soft key resets the above two counts to zero.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

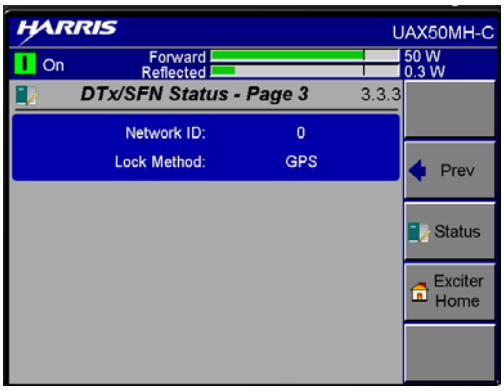


Figure 3-62 ATSC Modulator Status Screen (Page) 3

Figure 3-63 Xmtr Home>Exciter Home>Status>ATSC Modulator>Next>Next (screen 3)

Field	Explanation
Network ID	This is the Network ID entered at the distributed transmission adapter. In the USA, is customary to use the assigned TSID for the station as the network ID.
Lock Method	ATSC's A/110 standard specified two methods to achieve timing reference for SFN emission, they are GPS and stream locked. In the stream locked mode, the exciter extracts it's timing from the 19.39 MHz clock embedded in the transport stream. The exciter section only supports GPS locked mode. This mode is set by the distributed transmission adapter. If another manufacturer's adapter is being used and it has been set up for stream locked mode, the M2X will not lock and a fault will be indicated.
Watermark Serial Data Inhibited	RF Watermark is a slow speed serial data stream that can be modulated onto each of the 8 symbol levels emitted. This enables use of specialized test equipment in the field to figure out which transmitters are being received in an SFN environment. In addition to transmitter identification, the RF Watermark can be used as a slow-speed serial communication channel. The M2X does not currently support this channel, but the DTxA has the ability, in compliance with the standard, to tell a downstream modulator to inhibit the modulation of this data on the watermark or not. This is a read back of the setting of that bit in the DTxP.

WARNING: Disconnect primary power prior to servicing.

Figure 3-63 Xmtr Home>Exciter Home>Status>ATSC Modulator>Next>Next (screen 3)

Field	Explanation
Bury Ratio	Bury ratio tells how many dBs the RF watermark is "buried" underneath the main 8 modulation levels of the symbols. 0 = off, no ratio 1 = 39 dB below the main. 2 = 36 dB below the main. 3 = 33 dB below the main. 4 = 30 dB below the main. 5 = 27 dB below the main. 6 = 24 dB below the main. 7 = 21 dB below the main. A warning will appear in the fault log for levels of 5 or higher, indicating that the output signal to noise achievable is being limited by the RF watermark insertion.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.13 Status Screens - CTTB/CMMB Modulation

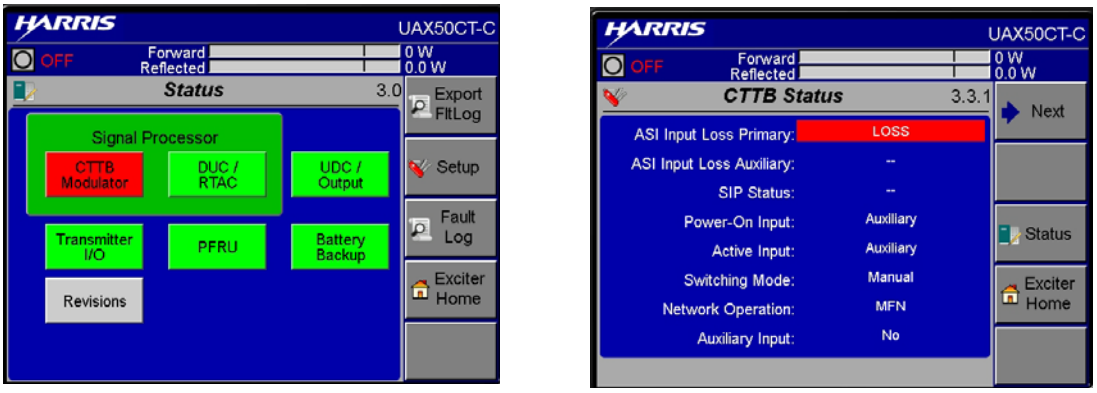


Figure 3-64 *on left* - CTTB Main Status Screen *on right* - CTTB Modulator Status Screen 1

Figure 3-65 Xmtr Home>Exciter Home>Status>CTTB Modulator (screen 1)

Field	Explanation
ASI Input Loss Primary	Display only showing the status of the primary transport stream (ASI 1). Red = loss of transport stream, Green = transport stream present.
ASI Input Loss Auxiliary	Display only showing the status of the auxiliary transport stream (ASI 2). Red = loss of transport stream, Green = transport stream present.
SIP Status	**:** Displays status of this parameter.
Power-On Input	Displays the selected transport stream (primary of secondary).
Active Input	Displays the selected transport stream (primary or secondary) which is active (on the air).
Switching Mode	Possibilities are Automatic or Manual. Displays the selected transport stream switch mode. If in the automatic mode and the current ASI stream has an issue or drops out, and the Auxiliary Input is set to Yes, the system will switch to the auxiliary ASI stream if it is available and good.
Network Operation	Displays the network configuration mode MFN (multiple frequency network) or SFN (single frequency network).
Auxiliary Input	Indicates yes or no. If yes is selected the exciter can be made to switch to an auxiliary input if the active input faults or drops out.
Softkeys	
Export Fault Log	Save fault log to file for export. Use File>Save Page to save HTML or text.
Setup	Displays Setup screen.

WARNING: Disconnect primary power prior to servicing.

Figure 3-65 Xmtr Home>Exciter Home>Status>CTTB Modulator (screen 1)

Field	Explanation
Fault Log	Displays Fault Log.
Exciter Home	Displays Exciter Home screen.
Status	Displays Status screen.

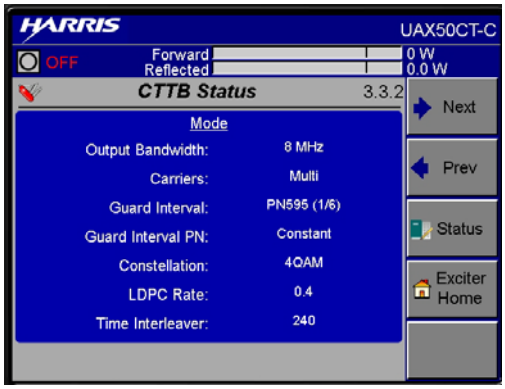


Figure 3-66 CTTB Modulator Status Screen 2

Figure 3-67 Xmtr Home>Exciter Home>Status>CTTB Modulator>Next (screen 2)

Field	Explanation
Output Bandwidth	Displays RF Output bandwidth. Presently fixed at 8 MHz. Future options are 7 MHz, 6 MHz or 5MHz.
Carriers	Displays the number of RF carriers in the output signal. Present values are Multi, Single, or Two Pilot. Multi = COFDM type modulation, Single = single carrier modulation system, Two Pilot = single carrier modulation mode with two pilots
Guard Interval	Displays the guard interval time. Presently fixed at PN595 (1/6). Options are PN945 (1/4), PN595 (slightly less than 1/6), or PN420 (1/9). This is the length of the guard interval in symbols. The total frame length is 3780 symbols. Guard interval is the guard interval symbol length divided by the total symbol length. Example: 945/3780 = 1/4.
Guard Interval PN	Displays options, which are variable or constant. Constant only used with PN595, Variable is used with PN945 and PN420
Constellation	Display choices are 4QAM, 16QAM, 32QAM, or 64QAM.

WARNING: Disconnect primary power prior to servicing.

Figure 3-67 Xmtr Home>Exciter Home>Status>CTTB Modulator>Next (screen 2)

Field	Explanation
LDPC Rate	Display values are 0.4 (2/5), 0.6, (3/5) or 0.8 (4/5). The LDPC Rate provides three rates of forward error correction. The decimal, or fraction, gives the relative efficiency of the forward error correction by dividing the information bits by the total block length. For example, block length = 7488 bits, information bits = 3008, therefore: 3008/7488 = 0.4 or 2/5. This indicates that there are two information bits for every five output bits.
Time Interleaver	Display values are 240 or 720symbols. This is a data convolutional interleaver. The data is interleaved to a depth of 240 or 720 symbols.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

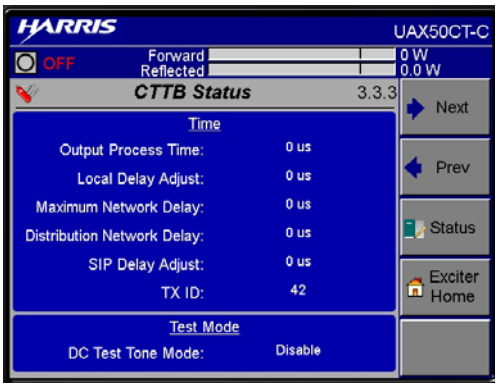


Figure 3-68 CTTB Modulator Status Screen 3

Figure 3-69 Xmtr Home>Exciter Home>Status>CTTB Modulator (screen 3)

Field	Explanation
Output Process Time	Displays throughput delay, measured after it leaves the exciter network delay circuit and travels to the output of the transmitter. This delay is important if the network consists of transmitters from different manufactures, where the output process time will change from one manufacturer to another.
Local Delay Adjust	Displays offset time, which is used, along with other delays, to calculate the exciter data storage time. It is needed to synchronize the data arrival at the single frequency network overlap zone when it is not located at the geographic center of two or more transmitters.
Maximum Network Delay	Additional delay added in order to be able to easily add a transmitter to the network without having to adjust the delay of all network transmitters. This delay is set in the distribution network control center.
Distribution Network Delay	Display of the delay from the distribution network common point to each transmitter in the single frequency network. It is usually measured automatically in each transmitter exciter and displayed here. This delay varies from transmitter to transmitter and must be taken into account in order to synchronize the data output from each transmitter.
SIP Delay Adjust	Displays status of this parameter
TX ID	Displays identification number assigned to this transmitter, which is part of a single frequency network. The ID is necessary to allow communication with and control of each transmitter in a single frequency network.
DC Test Tone Mode:	Displays test status, which is Disable or Enable. Enabling the DC Test Tone Mode transmits a single tone which is placed at the center of the spectrum. It is used to measure carrier frequency. The single tone signal is the same power as the exciter is putting out normally.

WARNING: Disconnect primary power prior to servicing.

Figure 3-69 Xmtr Home>Exciter Home>Status>CTTB Modulator (screen 3)

Field	Explanation
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

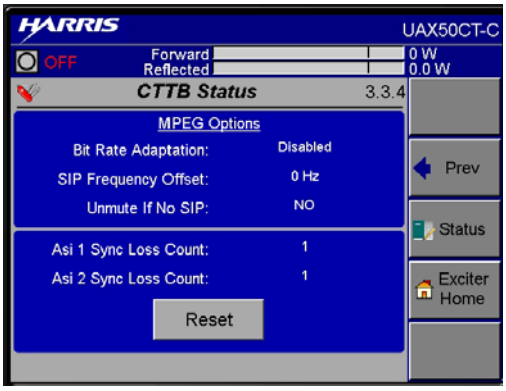


Figure 3-70 CTTB Modulation Status Screen 4

Figure 3-71 Xmtr Home>Exciter Home>Status>CTTB Modulator (screen 4)

Field	Explanation
Bit Rate Adaptation	Display state is Disabled or Enabled. This applies only to MFN mode. Bit Rate Adaptation will drop all incoming null packets, introduce new null packets as appropriate to manage the data rate and restamp Program Clock Reference (PCR) appropriately. This is null packet insertion and PCR (program clock rate, time stamp to synchronize the receiver) restamp i ng.
SIP Frequency Offset	Displayed in Hz. This is a frequency offset which may be necessart when operating in SFN mode.
Unmute if No SIP	Display state is No or Yes. Controls whether or not the M2X is released from mute if no SIP packet is detected in SFN mode. This is a network safeguard. (SIP = Second Frame Initialization packet).
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.14 Status Screens - ISDB-T Modulation

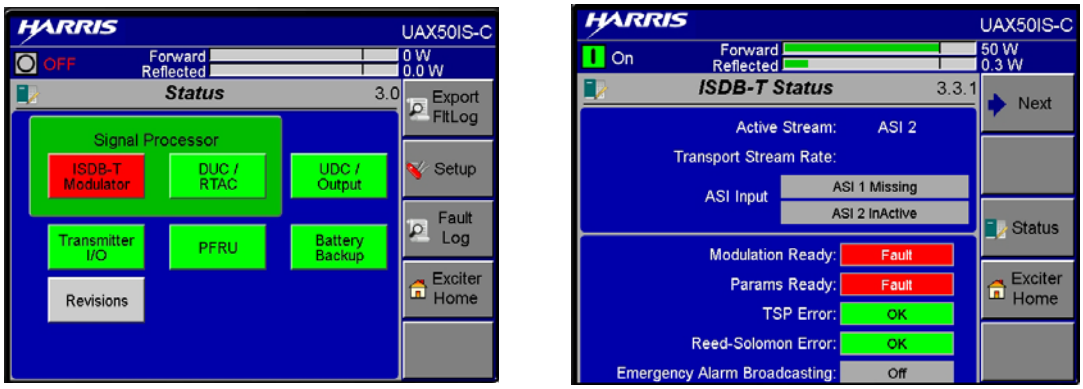


Figure 3-72 *on left*-ISDB-T Main Status Screen *on right*-ISDB-T Modulator Status Screen 1

Figure 3-73 Xmtr Home>Exciter Home>Status>ISDB-T Modulator (screen 1)

Field	Explanation
Active Stream	Display only showing which transport stream (ASI 1 or ASI 2) is on the air.
Transport Stream Rate	Input bit rate of the active ASI transport stream.
ASI Input	Green = transport stream Present. Red = transport stream selected as active is missing. May be Grey and indicates stream is missing or inactive.
Modulation Ready	Green = Modulator has ASI lock, parameters ready, the internal initialization is complete, and the ASI FIFO buffer is at least 1/2 full (ASI FIFO watermark is valid). Red = Modulator waiting for the above conditions to complete.
Param(eter)s Ready	Green = An IIP TSP (Transport Stream Packet) has been received and the modulator has been configured with modulation parameters. Red = The modulator has not received an HP TSP for configuration. (HP = ISDB-T Information Packet.)
TSP Error	Green = System OK. Red = When NULLs are inserted due to packets that did not arrive within the (50.2656 us + 1 us) window.
Reed-Solomon Error	Green = no error, Red = errors exist.
Emergency Alarm Broadcasting	Start flag for emergency alarm broadcasting. Green = Startup control available. Plain = No startup control.
Softkeys	
Export Fault Log	Save fault log to file for export. Use File>Save Page to save HTML or text.
Setup	Displays Setup screen.

WARNING: Disconnect primary power prior to servicing.

Figure 3-73 Xmtr Home>Exciter Home>Status>ISDB-T Modulator (screen 1)

Field	Explanation
Fault Log	Displays Fault Log.
Exciter Home	Displays Exciter Home screen.
Status	Displays Status screen.

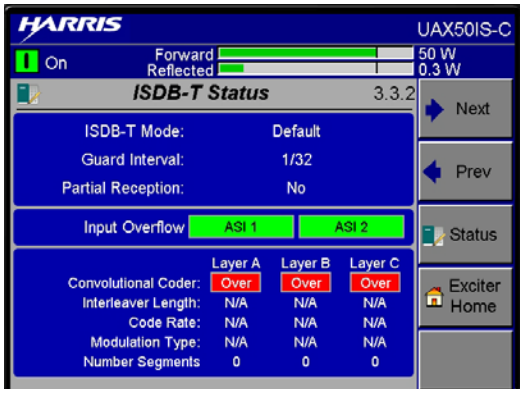


Figure 3-74 *on left* - ISDB-T Modulator Status Screen 2

Figure 3-75 Xmtr Home>Exciter Home>Status>ISDB-T Modulator>Next (screen 2)

Field	Explanation
ISDB-T Mode	ISDB-T mode (see Section 2.3 of ARIB STD B-31). Will display mode 1, 2 or 3.
Guard Interval	Display only, this is the length of the guard band, expressed as a fraction of the useful symbol time. Values are 1/4, 1/8, 1/16, or 1/32 of the OFDM Symbol Length. (see Section 3.14.2 of ARIB STD B-31).
Partial Reception	Partial reception flag Yes = Partial reception available. No = No partial reception.
Input Overflow	Status of ASI 1 and ASI 2. Green = OK. Red = overflow
Convolutional Coder	Layers A, B, and C. Green = OK, Red = Fault.This represents the Convolutional Coder FIFO underflow and overflow faults for the three layers.
Interleaver Length	Layers A, B, and C. Further information is provided in Table 3-12 in ARIB STD B-31.
Code rate	Layers A, B, and C. This is the Convolutional Coding rates for the three layers. Display choices are 1/2, 2/3, 3/4, 5/6, 7/8.
Modulation Type	Layers A, B, and C. Display indicates modulation type for each layer; DQPSK, QPSK, 16QAM, 64QAM.
Number Segments	Layers A, B, and C. This display indicates the number of segments which are assigned to layers A, B, and C.

WARNING: Disconnect primary power prior to servicing.

Figure 3-75 Xmtr Home>Exciter Home>Status>ISDB-T Modulator>Next (screen 2)

Field	Explanation
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

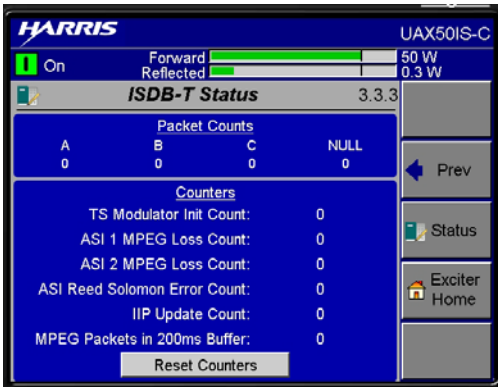


Figure 3-76 *on left* - ISDB-T Modulator Status Screen 3

Figure 3-77 Xmtr Home>Exciter Home>Status>ISDB-T Modulator>Next>Next (screen 3)

Field	Explanation
Packet Count A	Total number of layer A transport stream packets (TSPs) received. Count is reset when any parameter change.
Packet Count B	Total number of layer B transport stream packets (TSPs) received. Count is reset when any parameter change
Packet Count C	Total number of layer C transport stream packets (TSPs) received. Count is reset when any parameter change.
Null Packet Count	Total number of NULL transport stream packets (TSPs) received. Count is reset on any parameter change.
TS Modulator Init (initialization) Count	Number of time the modulator has been initialized by received parameter changes. This number increments each time the parameters change. This number is reset on power cycle or when Reset Counts is pressed.
ASI 1 MPEG Loss Count	This is a running count of how many times the modulator has lost lock with the 0x47 sync bytes in the transport stream. This number is reset on power cycle or when Reset Counts is pressed.

WARNING: Disconnect primary power prior to servicing.

Figure 3-77 Xmtr Home>Exciter Home>Status>ISDB-T Modulator>Next>Next (screen 3)

Field	Explanation
ASI 2 MPEG Loss Count	This is a running count of how many times the modulator has lost lock with the 0x47 sync bytes in the transport stream. This number is reset on power cycle or when Reset Counts is pressed.
ASI Reed Solomon Error Count	The R-S Error count accumulates the number of errors detected on the input transport stream. This does not necessarily indicate these were un correctable errors, but more of an indication that errors were present on the input. This number is reset on power cycle or when Reset Counts is pressed.
IIP Update Count	Counter storing number of times IIP Update is detected. This number is reset on power cycle or when Reset Counts is pressed. IIP = ISDB-T Information Packet.
MPEG Packets in 200ms Buffer	The MPEG Packets in the 200ms Buffer refer to the depth of the input buffer. In order to lock to the input transport stream a buffer with a watermark indicator is used. The depth is read once a second and the FFT clock is adjusted until 100ms of data is maintained in the buffer. This is not applicable in SFN mode.
Reset Counters	Soft key, when pressed, resets the above counters to zero.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.15 Status Screens - DVB-T Modulation

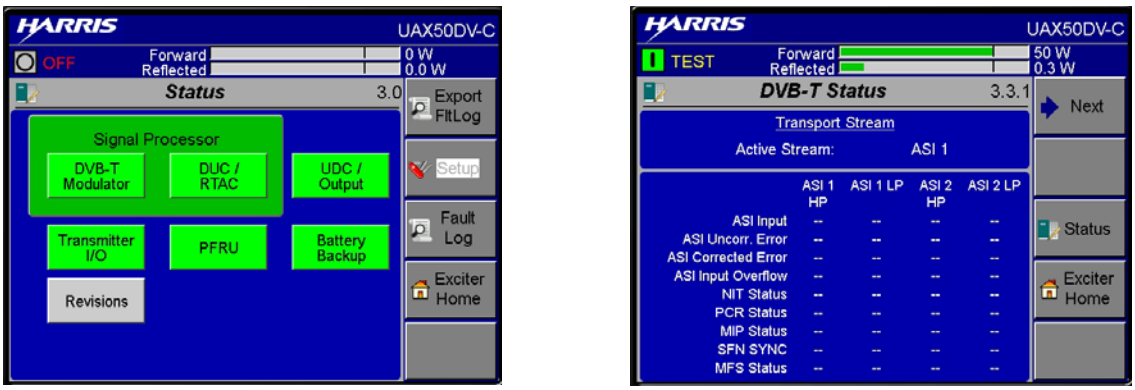


Figure 3-78 DVB-T Status Screen (left) -DVB-T Modulator Status Screen 1 (right)

Figure 3-79 Xmtr Home>Exciter Home>Status>DVB-T Modulator (screen 1)

Field	Explanation
Active Stream	Displays Active Transport stream.
ASI Packet Status	In non-hierarchy mode only the high priority (HP) input is used. In hierarchy mode both high priority (HP) and low priority (LP) inputs are used. The DVB-T Packet Status sub window displays the status of parameters for the four **ASI** input transport streams shown following: ASI 1 HP: Primary input, high priority channel ASI 1 LP: Primary input, low priority channel ASI 2 HP: Auxiliary input, high priority channel ASI 2 LP: Auxiliary input, low priority channel
ASI Input	"OK" if input is present, "Error" if input missing.
ASI Uncorr(ected) Error	ASI Uncorr(ected) Error displays "OK" if no errors are uncorrected, "Error" if some packets had errors that could not be corrected by Reed-Solomon error correction.
ASI Corrected Error	ASI Corrected Error displays "**OK**" if no errors detected, "**Error**" if some packets had errors that were corrected by Reed-Solomon error correction.
ASI Input Overflow	ASI Input Overflow displays "OK" if input data rate OK. "Error" if input data rate too high (FIFO overflow).
NIT Status	NIT Status displays “NIT OK” if an NIT (Network Information Table) packet is detected in input transport stream. If no NIT packets are detected then “No NIT” will be displayed.
PCR Status	PCR Status displays “PCR OK” if PCR (Program Clock Reference) has been detected in transport stream. If no transport stream is present it will display “No NIT”. If transport stream is present, but PCR is not present it will display “No NIT”.

WARNING: Disconnect primary power prior to servicing.

Figure 3-79 Xmtr Home>Exciter Home>Status>DVB-T Modulator (screen 1)

Field	Explanation
MIP Status	MIP (Mega-frame Initialization Packet) Status displays “MIP OK” if MIP packets are detected in transport stream and they have no errors. If no MIP packets are detected, or if there are MIP packet errors, it will display “Error. If the input is not required then “N/A” will always be displayed.
SFN Sync	SFN (Single Frequency Network) Sync displays “OK” if VAX-C in the SFN (Single Frequency Network) mode and the mega-frame timing is properly aligned. If in SFN mode and the mega-frame timing is not properly aligned an “Error” will be displayed. If not in SFN mode or if the input is not required, then “OK” is always displayed.
MFS Status	MFS Sync (Mega Frame Sync) displays “OK” if MPEG sync word 0x47 is detected properly in transport stream input. If MPEG sync word is not detected properly then “Error” will be displayed. If the input is not required, then “OK” is always displayed.
Softkeys	
Export Fault Log	Save fault log to file for export. Use File>Save Page to save HTML or text.
Setup	Displays Setup screen.
Fault Log	Displays Fault Log.
Exciter Home	Displays Exciter Home screen.
Status	Displays Status screen.

WARNING: Disconnect primary power prior to servicing.

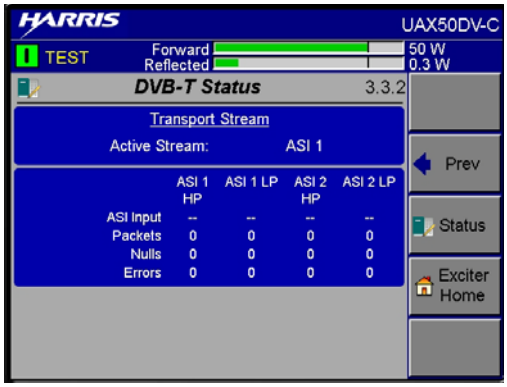


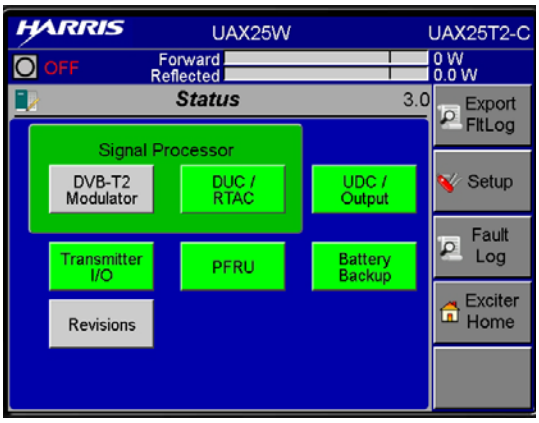
Figure 3-80 - DVB-T Modulator Status Screen 2

Figure 3-81 Xmtr Home>Exciter Home>Status>DVB-T Modulator>Next (screen 2)

Field	Explanation
Active Stream	Displays Active Transport stream.
ASI Packet Status	In non-hierarchy mode only the high priority (HP) input is used. In hierarchy mode both high priority (HP) and low priority (LP) inputs are used. The DVB-T Packet Status sub window displays the status of parameters for the four ASI input transport streams shown following: ASI 1 HP: Primary input, high priority channel ASI 1 LP: Primary input, low priority channel ASI 2 HP: Auxiliary input, high priority channel ASI 2 LP: Auxiliary input, low priority channel
ASI Input	"OK" if input is present, "Error" if input missing.
Packets	Displays the number of transport packets received in one second.
Nulls	Displays the number of Null transport packets received in one second.
Errors	Displays the number of transport packets with errors received in one second.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.16 Status Screens - DVB-T2 Modulation



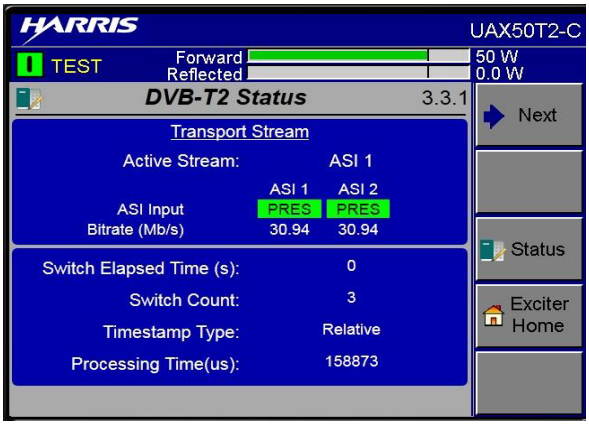


Figure 3-82 ***on left*** **DVB-T2 Main Status** ***on right*** **DVB-T2 Modulator Status Screen 1**

Figure 3-83 Xmtr Home>Exciter Home>Status>DVB-T2 Modulator (screen 1)

Field	Explanation
Active Stream	Displays Active Transport stream.
ASI Input	If the ASI input is present with no errors, a green box with the word PRES appears under the label. The area under the label remains blue with -- if input is absent.
Bitrate (Mb/s)	Displays total transport stream bit rate for each ASI input.
Switch Elapsed Time (s)	Displays time elapsed since switchover.
Switch Count	Displays the number of switchovers since last reset.
Timestamp Type	Indicates mechanism for synchronizing output of transmitters signaled by T2 gateway (see TS 102 773 section 5.2.7). Only required in T2MI mode. *Relative* = timestamp only contains time of emission relative to next 1 pps (subseconds) *Absolute* = timestamp includes absolute time of emission *Null* = timestamp packet detected, but no timing alignment required *N/A* = no timestamp packet required/detected (MPEG-TS mode)
Processing Time	Internal processing delay of modulator. This value is used in planning of SFN network timing. Processing time is delay from reception of L1 packet (end of T2 frame) at transport input to I/Q data ready into SFN delay memory.
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

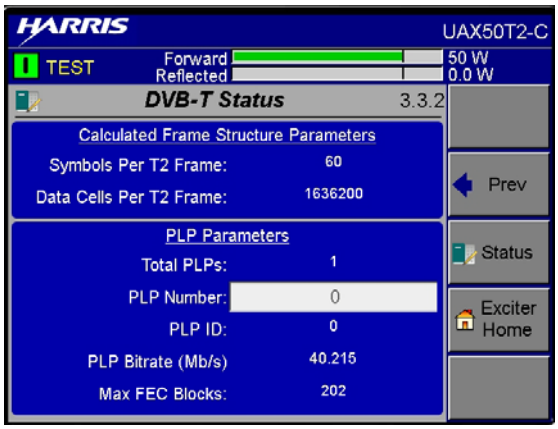


Figure 3-84 DVB-T2 Status Modulator Screen 2

Figure 3-85 Xmtr Home>Exciter Home>Status>DVB-T2 Modulator (screen 2)

Field	Explanation
Symbols Per T2 Frame	The total number of symbols per T2 frame. This is data symbols plus P1 symbols.
Data Cells Per T2 Frame	Data cells per T2 frame < subcarriers per symbol X symbols per T2 frame. Maximum is 13920 X 138. This is reduced by pilot subcarriers and L1 signaling cells.
Total PLPs	Total number of Physical Layer Pipes (PLP) sent in the T2 transmission super-frame. In MPEG-TS input mode there is only 1 PLP. In T2MI input mode there can be multiple PLPs from 1 to 255.
PLP Number	The number of an individual PLP for parameter entry/display. In MPEG-TS mode the PLP Number is 0 fixed. In T2MI mode the user can select PLP Number from 0 to 254.
PLP ID	PLP identifier number for the selected PLP Number. Range 0-254 set by T2 gateway (PLP_ID from EN 302 755, section 7.2.3.1).
PLP Bitrate (Mb/s)	Calculated payload bit rate for the selected PLP Number.
Max FEC Blocks	Maximum number of forward error correction blocks per interleaver frame for the selected PLP number (PLP_NUM_BLOCKS_MAX from EN 302 755, section 7.2.3.1).
Softkeys	
Status	Displays Status screen.
Exciter Home	Displays Exciter Home screen.

WARNING: Disconnect primary power prior to servicing.

3.17 Status Screens - DAB Modulator

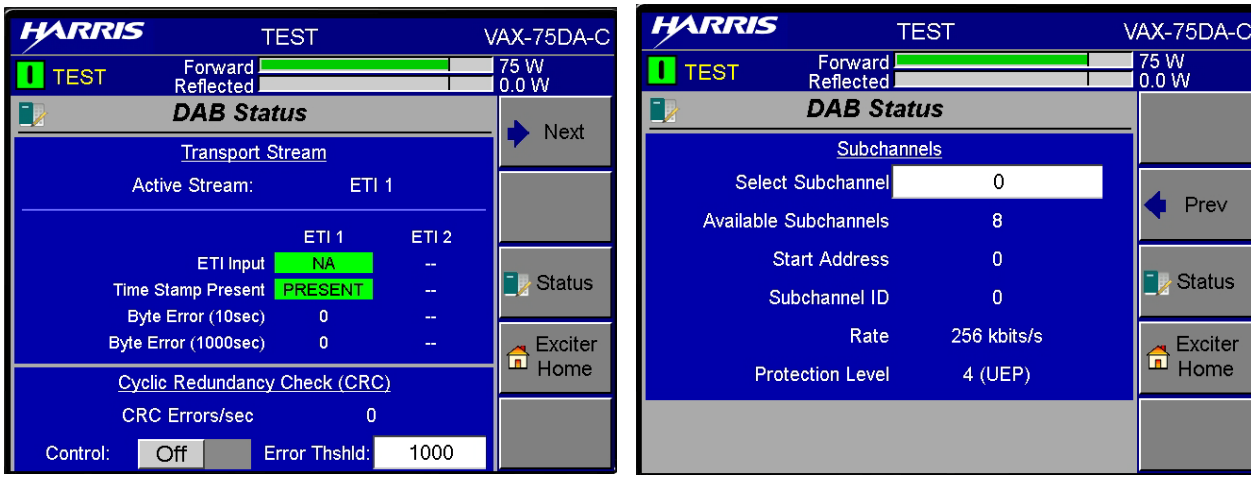


Figure 3-86 DAB Status Screens 1 & 2

Table 3-61 Xmtr Home>Exciter Home>Status>DAB Modulator &> Next

Field	Explanation
Transport Stream	
Active Stream	Displays active transport stream. ETI 1 or 2.
ETI Input	Displays Status of this parameter.
Time Stamp Present	Displays Status of this parameter.
Byte Error (10sec)	Numerical readout for ETI1 and ETI2.
Byte Error (1000sec)	Numerical readout for ETI1 and ETI2.
Cyclic Redundancy Check	
CRC Errors/sec	Displays Status of this parameter.
Control	Off/On
Error Thresh.	Set desired value.
Subchannels	
Select Subchannel	Enter desired subchannel.
Available Subchannels	Displays Status of this parameter.
Start Address	Displays Status of this parameter.
Subchannel Number	Displays Status of this parameter.

WARNING: Disconnect primary power prior to servicing.

Table 3-61 Xmtr Home>Exciter Home>Status>DAB Modulator &> Next

Field	Explanation
Rate	Displays Status of this parameter
Protection Level	Displays Status of this parameter.
Softkeys	
Status	Opens Status screen as shown in Figure 3-51 on page 3-81
Exciter Home	Pressing this soft key displays Exciter Home Screen.

Section 4 Theory of Operation

4

4.1 Introduction

This section contains detailed descriptions of the VAX-C Series transmitter, its internal sub-assemblies and any pertinent information regarding external assemblies.

This chapter contains four sections:

- Introduction
- Logic Symbols
- Block Diagrams
- Modulator Overview

4.2 Active Logic Symbols

Each logic signal has an active and inactive state and a unique name within the system. To differentiate between active high or active low logic states on the schematics, a forward slash (/) is placed in front of an active LOW signal name such as /RF_MUTE. This means that if this logic line is pulled low, the transmitter RF will be muted. By the same logic, the signal RF_MUTE_LED (an active high signal with no forward slash) will turn on the RF mute LED when it goes high.

In some cases, a logic signal may act as a toggle with both states active, as with the signal /ON_OFF, where LOW = ON and a HIGH = OFF. If this signal is inverted it would be ON_/OFF.

WARNING: Disconnect primary power prior to servicing.

4.3 Block Diagram

See Section 1 in this manual for a basic transmitter overview, model numbers and block diagram (Figure 1-4, on page 1-9). As a standard practice, the first page of a PC (printed circuit) board schematic is also a block diagram for that board. Table 1-1 on page 1-5 gives the basic Platinum model numbers and configurations.

Figure 4-1 is a simplified transmitter system RF block diagram. This diagram shows the transport stream input to the modulator, the modulator RF output signal connected to the driver input, and the PA output connected to the PA directional coupler. Outside the transmitter encloser, the output of the PA coupler is connected to the high power filter input and the output of the high power filter connected to the directional coupler. The coupler output is connected to the antenna or the test load.

Two RF feedback signals are connected from the transmitter RF output system to the modulator. These feedback signals are taken before and after the high power filter, which follows the PA, and are needed to perform the non-linear and linear RTAC (real time adaptive correction) precorrection of the modulator RF output signal. The PA (pre filter) RTAC feedback signal is internally routed in the transmitter. The high power filter and its output coupler are located outside the transmitter enclosure, and therefore the post-filter RTAC feedback signal is routed externally from the output coupler to an SMA connector on the rear panel of the transmitter. See Figure 1-3 on page 1-4 for the post-filter sample connector.

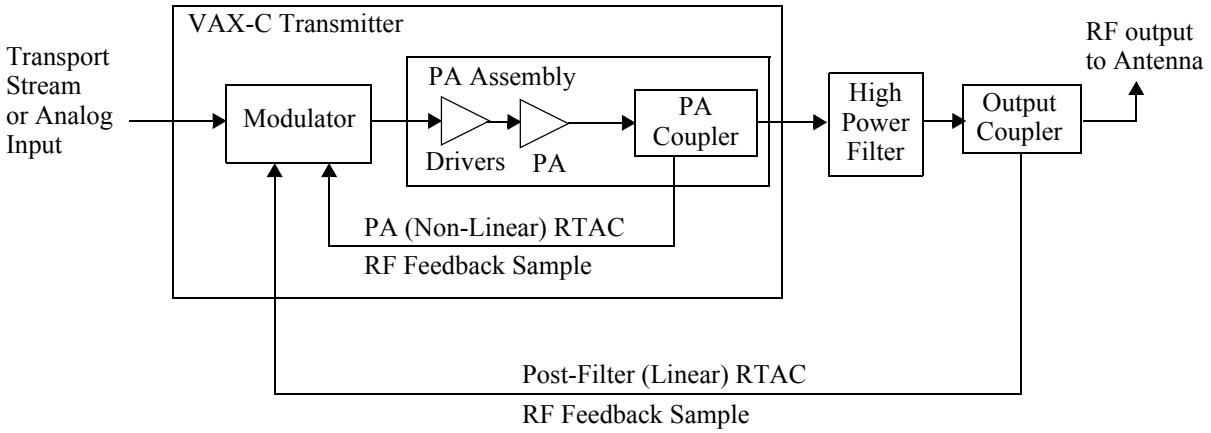


Figure 4-1 VAX-C Transmitter - RF Interconnection Block Diagram

WARNING: Disconnect primary power prior to servicing.

RTAC precorrection is used to cancel the nonlinear distortions generated in the PA assembly and the linear distortions generated in the high power bandpass filter which follows the PA.

4.4 Modulator Overview

Figure 4-2, on page 4-5 is an overall block diagram of the LPU modulator section. Refer to it while studying the modulator assembly.

The VAX-C modulator section consists of 7 circuit boards including:

- Signal Processor Board.
- PFRU (Precise Frequency Reference Unit Board.
- Up Down Converter Board. This assembly consists of a UDC Base I/O (input/output) board and a piggy backed UDC board.
- Power Supply and Low Voltage Distribution Board.
- Battery Backup Option Board.
- Front Panel LED and Switch Board.
- Transmitter I/O (input/output) Interface Board is piggy backed under the right rear side of the signal processor board. This board can be inserted and removed through the rear panel of the VAX-C chassis.

The amplifier section of the VAX-C consists of the following:

- Power Amplifier Board, which is mounted in the PA assembly
- PA Interface Board, which is mounted on the left side of the PA assembly.
- AC/DC Converter Board, which is mounted on the AC/DC converter assembly.

Signal flow through the VAX-C is shown by the wide dark lines in Figure 4-2, on page 4-5.

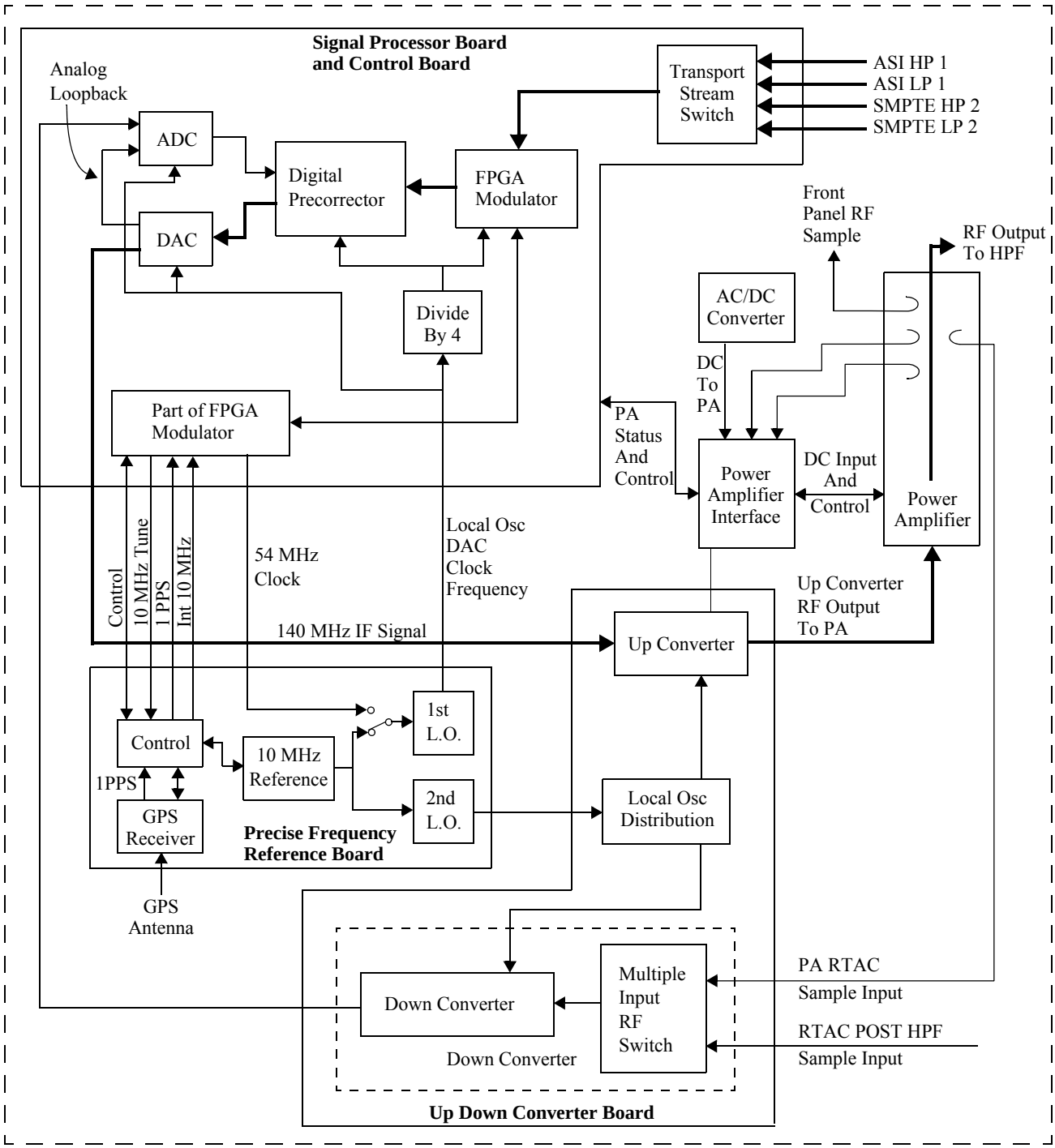


Figure 4-2 VAX-C Modulator - Signal Flow Block Diagram

WARNING: Disconnect primary power prior to servicing.

4.4.1 Signal Processor Board Overview

The signal processor board serves as a motherboard for the UAC-C Transmitter modulator. The board interfaces to all the boards in the modulator. Refer to Figure 4-2 on page 4-5.

The signal processor board also serves as the ASI input and output, decoder and encoder, the modulator, the digital precorrector (RTAC circuit for digital modulation modes), and it contains the ADC and DAC which interfaces to the up/downconverter board RF connections. The signal processor board has control interfaces to the transmitter I/O Interface board, the PA Interface board (which in turn connects to the up\down converter board), the PFRU board, the front panel, and the LVPS.

Power for the signal processor board is derived from the LVPS, which delivers +5Vdc, +12Vdc, -12V, +24Vdc, and +12VBATT. All other voltages necessary for the signal processor board are derived from these inputs. All boards receive their power through the signal processor board.

Monitoring of the power supplies and ambient temperature are performed by the micro module, which is a daughter board mounted on the bottom right, rear corner of the signal processor board. The micro module also initiates offline tests requested by the user, such as memory tests, serial channel loop back, predefined board level tests, and predefined LPU tests.

4.4.1.0.1 DAC

The DUC writes the 16-bit I and Q data to the AD9779 DAC. The DAC will be clocked by the ~409 to 460 MHz clock from the PFRU. The 1/4 F_{DAC} clock output of the DAC is used as a clock for the DUC FPGA and the RF Sample ADC. The DAC will provide the Up/Downconverter board with the 140MHz IF at a 0 dBm average level.

4.4.1.0.2 ADC

The AD9461 ADC will be clocked by the 1/4 FDAC clock. It will convert the 140 MHz IF from the downconverter to a 16 bit sample provided to the DUC FPGA. The ADC will also provide the DUC FPGA with the Sample A/D clock.

4.4.2 The Modulation Process

The transport stream inputs are applied to the FPGA modulator.

The modulator will process the transport stream and recover the data and the clock. In some modulation standards, the clocks required to synchronize several circuits in the signal processing board are phase locked to the recovered transport stream clock.

During the modulation process the FPGA modulator adds forward error correction to the digitized signal. This forward error correction includes, but is not limited to, data randomization, Reed-Solomon coding, data interleaving, and trellis coding. Some modulation methods may use convolutional coding and frequency division multiplex. The signal is also band-limited using a digital filter.

The FPGA modulator sends the digitized, processed, and bandpass filtered IF signal to the digital upconverter and precorrector circuit.

The precorrector uses RTAC to apply precorrection to the digitized IF signal based on the down converted, digitized RF samples from before and after the high power filter.

The fully processed and precorrected digitized IF signal, resulting from various digital operating modes, is processed into a 140 MHz (center frequency) IF signal by the DAC (Digital to Analog Converter).

The 140 MHz IF signal is sent to the upconverter circuit of the up/downconverter board, where it is heterodyned up to the on channel frequency and amplified. The modulator maximum output level is 6 dBm (4 mW average) in any digital mode. The 50 watt PA requires 2.5 mW of input drive power and the 25 watt PA requires 2.24 mW of drive.

4.4.3 RF Sample Processing

The RTAC algorithm compare the processed and filtered digitized IF signal from the modulator to the digitized RF samples in order to apply the correct precorrection to the signal to accommodate the linear and nonlinear distortion. The RF samples for the RTAC algorithm must be selected one at a time, the level set, the sample down converted to the 140 MHz IF frequency, and then digitized and sent to the digital precorrector circuit.

The input to the downconverter is an electronic switch, which is controlled by the signal processor board.

The level of the selected signal is set to the optimum level for the downconverter mixer by an attenuator, which is controlled by the signal processing board.

WARNING: Disconnect primary power prior to servicing.

The signal is next applied to a mixer, along with the local oscillator signal from the 2nd local oscillator phase lock loop circuit in the precise frequency reference board.

The resultant 140 MHz IF signal is then filtered to remove mixing products and sent to an attenuator controlled from the signal processor board. Here its level is set to optimum for its next destination, the ADC (Analog to Digital Converter) in the signal processor board.

In the ADC, the IF signal is digitized and sent to the digital precorrector (RTAC) circuit.

RTAC performs two functions, which are:

- Non-linear precorrection to cancel the phase and linearity distortions created in the drivers and PA
- Linear precorrection to cancel the amplitude response and group delay) distortions created in the high power filter.

4.4.4 Low Voltage Power Supply Board

The low voltage power supply for the modulator is mounted to the left inside wall of the transmitter chassis. The following items are mounted on the power supply assembly:

- The AC Input connector.
- A +12V switching power supply, mounted towards the rear of the power supply assembly.
- Provision for an optional battery backup board, mounted at the front of the power supply board.
- The LVPS distribution board receives +12 Vdc from the switching supply. It uses it to generate the +24Vdc, +5Vdc, and -12Vdc outputs from dc to dc converters.
- The +24V, +12V, +12Vosc, +5V, and -12V are dc outputs supplied via a ribbon cable to the signal processor board. Power to the other boards is distributed via the signal processing board to the other subsystems.

The block diagram of the low voltage power supply is shown in Figure 4-3.

The part number for the power supply board, including the switching supply, is 971-0051-011G.

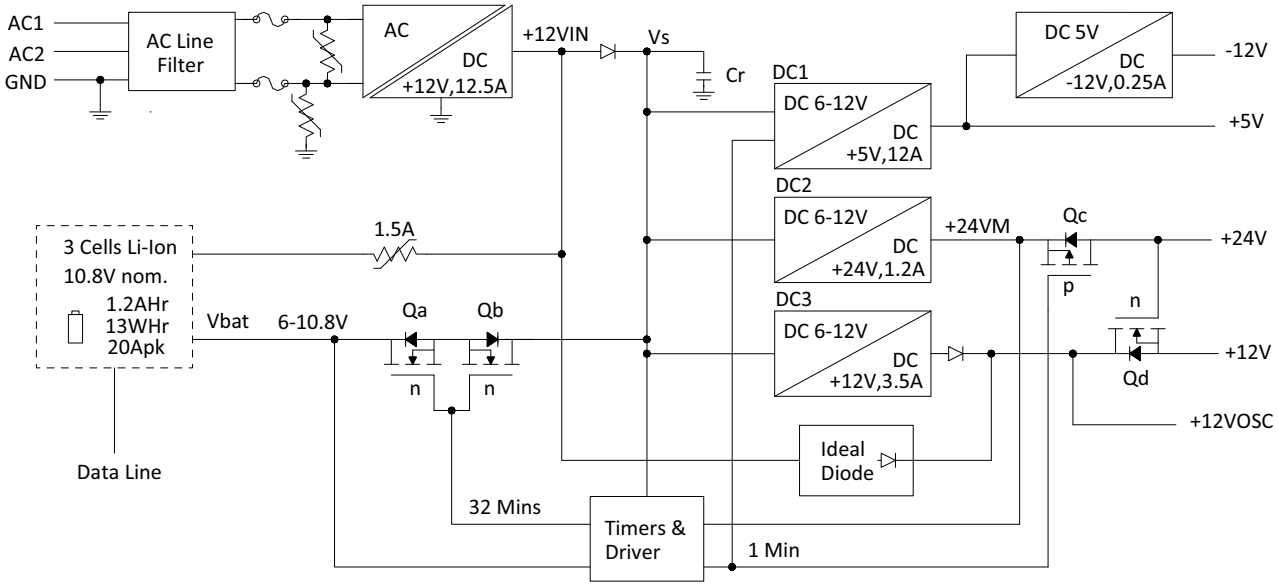


Figure 4-3 Low Voltage Power Supply Block Diagram

4.4.5 Battery Backup Option

The battery backup board interfaces directly to the LVPS board. Three Lithium-ion cells are used in a series arrangement and provide 9.6 volts at 1200mAh, 12WHr rated. The battery backup assembly consists of a battery backup circuit board with three Lithium-ion cells permanently attached; it also includes a custom battery charging circuit and protection circuitry. The batteries and circuit board are sold as a unit when replacement batteries are required.

The battery backup assembly part number is 971-0051-012G.

The battery backup supplies the LVPS board with +6.4V to 10.8V at 20A maximum. It is mounted directly to the LVPS board. A block diagram of the battery backup assembly is shown in Figure 4-4.

The battery backup assembly specifications are as follows.

- Recharge time for the fully discharged battery pack is two to three hours. The charge cycle starts and stops based on the battery pack output voltage.
- Under the optimum battery condition, this battery backup option is capable of one minute of operation of the modulator portion of the VAX-C transmitter following an ac power failure. This is accomplished by keeping

the +24V, +12V, +12Vosc, +5V, and -12V power supply interface board dc outputs energized for one minute following a power failure. *During this time the PA assembly is not powered.*

- It keeps the oscillator circuits and the internal GPS receiver operating for an additional fifteen minutes following the one minute modulator controller backup operation. It accomplishes this by de-energizing all but the +12Vosc power supply outputs.
- During the last fifteen minutes of battery backup operation, the battery backup maintains power to the 10MHz and 1PPS Input circuitry on the Signal Processing board and the FPGA, OCXO and GPS circuitry on the PFRU. By powering these circuits the modulator can maintain the 10MHz OCXO discipline loop when the transmitter loses power. The OCXO can take three minutes to stabilize from a cold start and the discipline loop itself can take an hour to reach the maximum precision; having the discipline loop active during a power outage enables the VAX-C transmitter to return to air faster with greater frequency accuracy.

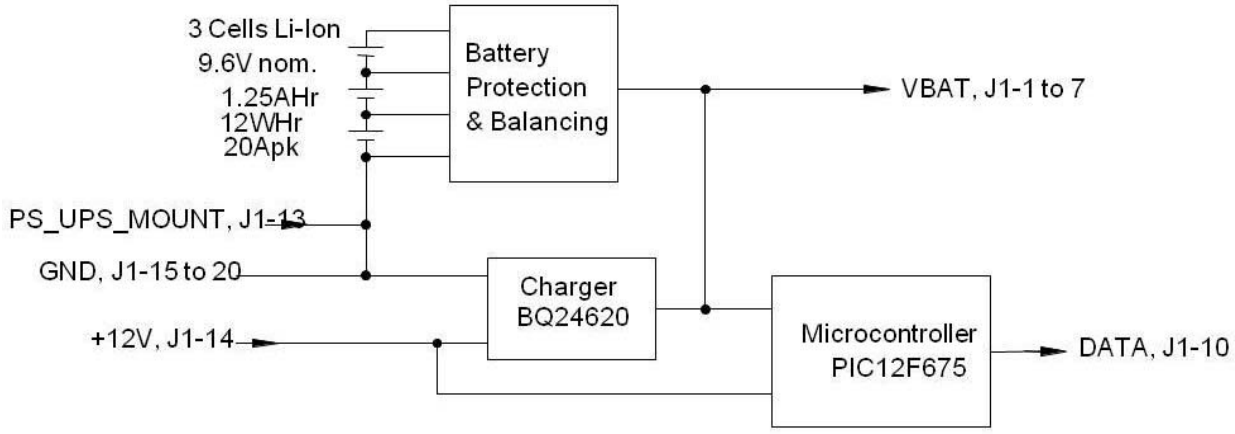
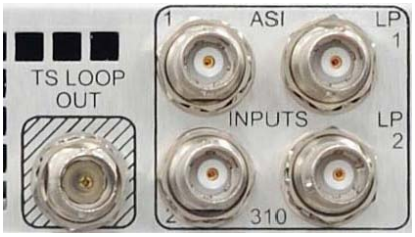


Figure 4-4 Battery Backup Block Diagram

4.4.6 ASI / SMPTE 310 Inputs / Output

The modulator FPGA decodes the four ASI inputs and modulates the active input stream with the selected standard. Transformers are used on the input of the ASI data to improve the rejection of common mode interference on the input cables. Cable equalization circuitry is also used. The ASI inputs to the FPGA are at LVDS levels.

Input choices are shown below, rear panel connectors are shown to the right.



- 1 -> ASI input (HP 1) for DVB modulation standard (top left connector)
- LP 1 -> ASI Input, LP 1 for DVB input, ATSC this will be the second ASI input, all other standards this is not used. (top right connector)
- 2 -> Secondary ASI input for all OFDM modulation standards. Also known as HP 2 for DVB. Primary SMPTE input for ATSC (bottom left connector)
- LP 2 -> ASI Input, LP 2 for DVB input, ATSC this will be the second SMPTE input, all other standards this is not used. (bottom right connector)

NOTE:
LP1 and LP2 inputs are used only for COFDM Hierarchial modes.

The modulator FPGA also provides an ASI monitor output. The ASI monitor output is at LVDS levels from the FPGA. It utilizes an LVDS (Low Voltage Differential Signal) driver and transformer per the ASI specification.

The DUC (Digital Up Converter) FPGA is responsible for taking the modulated data and applying correction, as well as up converting the baseband signal allowing the system to come out on the correct frequency to feed to the DAC. The DUC FPGA output data is then transferred to the DAC to be converted to a 140 MHz IF, which is then up-converted to the on channel frequency.

The DUC writes the 16-bit I and Q data to the AD9779 DAC. The DAC will be clocked by the ~409 to 460 MHz clock from the PFRU. The 1/4 F_{DAC} clock output of the DAC is used as a clock for the DUC FPGA and the RF Sample ADC. The DAC provides the Up/Downconverter board with the 140MHz IF.

The AD9461 ADC is clocked by the 1/4 FDAC clock. It converts the 140 MHz IF from the downconverter to a 16 bit sample provided to the DUC FPGA. The ADC also provides the DUC FPGA with the sample A/D clock.

4.4.7 PFRU (Precise Frequency Reference Unit) Board

The Precise Frequency Reference Unit (board) performs four functions through four circuits. They are as follows:

- Provides an optional GPS receiver unit
- 10 MHz reference oscillator
- 1st LO PLL
- 2nd LO PLL

4.4.7.1 PFRU Board 1st LO PLL for the DAC Clock Circuit

This PLL (Phase Lock Loop) oscillator provides a clock to the IF DAC (Digital to Analog Converter). It is used to produce a 140 MHz analog IF output from the signal processor board. The block diagram for local oscillator 1 is shown in Figure 4-5 on page 4-13.

Phase noise specification on DAC clock is given in Table 4-1.

Table 4-1 Phase Noise Limit For DAC Clock

Hertz	
10	-60 dBc/Hz
100	-90 dBc/Hz
1k	-95 dBc/Hz
10k	-100 dBc/Hz
100k	-117 dBc/Hz
1M	-135 dBc/Hz

This clock is sent to the signal processing board where it is used to generate the 140 MHz IF output signal, which is fed to the up/downconverter board. DAC clock frequencies for various modulation methods is shown in Table 4-2.

Each modulation method produces an IF frequency which is equal to 1/4 of the DAC clock frequency for that modulation system. Therefore, an offset frequency is produced by the FPGA modulator to bring the IF frequency to 140 MHz. The required offset frequency for each modulating system can be calculated using the following formula.

$$\text{Offset Frequency} = 140MHz - \frac{\text{DAC Clock Frequency}}{4}$$

Table 4-2 DAC Clock Frequencies

Modulation	DAC Clock Freq.	Offset Freq.
ATSC	430.489 MHz	32.378 MHz
DVB-T/H	438.857 MHz	30.286 MHz
ISDB-T	445.823 MHz	28.544 MHz
DMB-T	453.600 MHz	26.600 MHz
NTSC/PAL	436.800 MHz	30.800 MHz
DAB	409.600 MHz	37.600 MHz

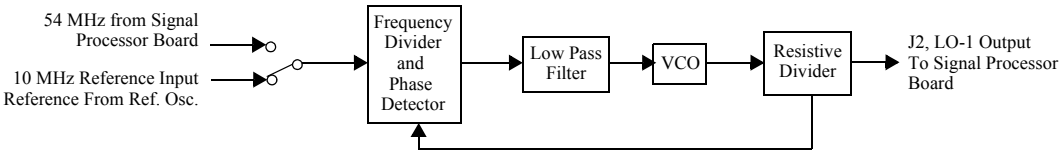

54 MHz from Signal Processor Board
10 MHz Reference Input Reference From Ref. Osc.
Frequency Divider and Phase Detector
Low Pass Filter
VCO
Resistive Divider
J2, LO-1 Output To Signal Processor Board

Figure 4-5 DAC PLL (1st LO)

WARNING: Disconnect primary power prior to servicing.

4.4.7.2 PFRU Board Local Oscillator-2 Circuit, For UDC

This circuit provides a local oscillator for the up/downconverter. It is used to heterodyne the IF signal to the on channel RF frequency in the upconverter and to heterodyne the RF sample back to the IF frequency in the downconverter. The phase noise specification for local oscillator 2 (the RF UDC PLL) is given in Table 4-3.

Table 4-3 Phase Noise Specification For RF PLL

Hertz	B IV, B V
10	-57 dBc/Hz
100	-87 dBc/Hz
1k	-92 dBc/Hz
10k	-97 dBc/Hz
100k	-114 dBc/Hz
1M	-132 dBc/Hz

The block diagram of local oscillator 2 is shown in Figure 4-6 on page 4-15. This circuit features an 800 to 1600 MHz voltage controlled oscillator, which is phase locked to a 10 MHz reference signal. The relationship between the various on channel frequency bands, the required local oscillator frequencies, and the status of the IF signal is given below and summarized in Table 4-4.

- The on channel output frequency is the sum of the IF and the local oscillator signals, therefore, the IF signal is not inverted.
- For band V and band IV, the oscillator output is divided by two, yielding an output range of 400 to 800 MHz. This signal is sent to the up/downconverter board.
- For band V, the on channel output frequency is the sum of the IF and the local oscillator signals, therefore, the IF signal is not inverted.
- For Band IV, the on channel output frequency is the difference between the IF and the local oscillator signals, therefore, the IF signal must be inverted.

WARNING: Disconnect primary power prior to servicing.

Table 4-4 RF UDC PLL Frequencies

Band	Channel Frequency Range	Local Osc Frequency Range	IF Frequency Order
BIII	168 to 242 MHz	168 to 242 MHz in 1Hz steps	Inverted

The IF and local oscillator frequencies will vary somewhat to accommodate the various modulation methods uses and the bandwidth of the output signal. Output signal bandwidth range is 5, 6, 7, or 8 MHz. The IF frequency tolerance of +/-0.5 MHz is needed to accommodate the various modulation methods used.

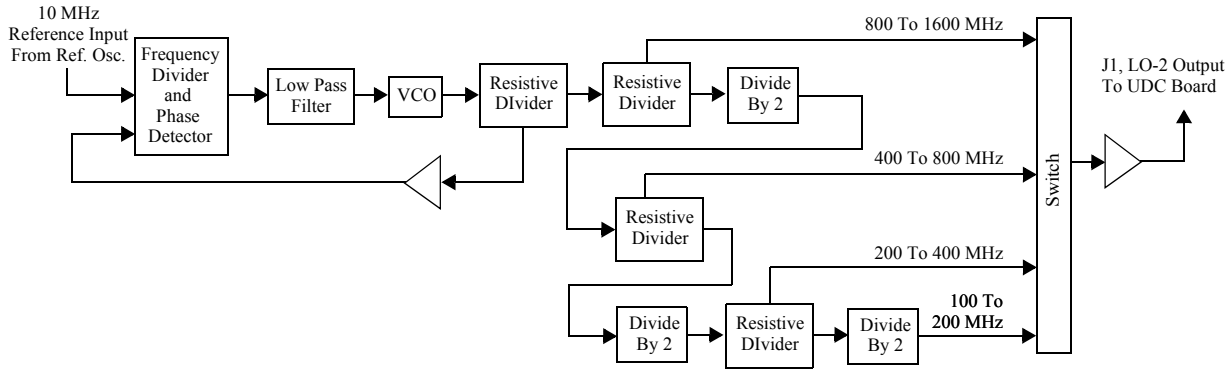


Figure 4-6 UDC Local Oscillator (2nd LO) PLL

4.4.7.3 PFRU Board Reference Oscillator Circuit

The PFRU reference oscillator circuit, shown in PFRU Board 10 MHz Reference Oscillator Circuit, provides four outputs, which are as follows:

- A 10 or 54 MHz reference for the DAC PLL oscillator
- A 10 MHz reference for the RF Up/Downconverter PLL oscillator
- A spare 10 MHz reference, at J3
- A 54 MHz reference to Level Detector

WARNING: Disconnect primary power prior to servicing.

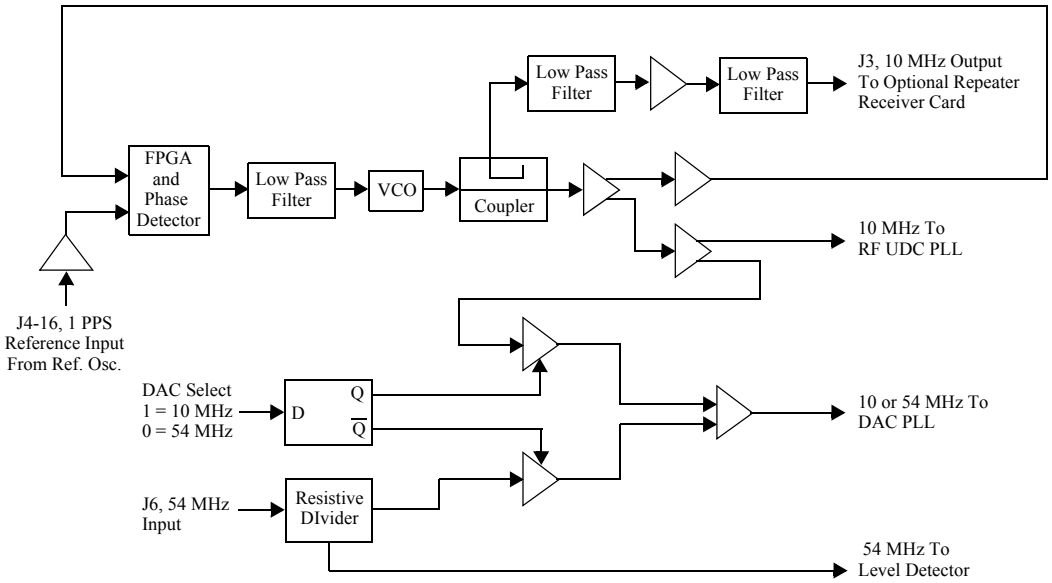

Low Pass Filter
Low Pass Filter
J3, 10 MHz Output To Optional Repeater Receiver Card
FPGA and Phase Detector
Low Pass Filter
VCO
Coupler
10 MHz To RF UDC PLL
J4-16, 1 PPS Reference Input From Ref. Osc.
DAC Select 1 = 10 MHz 0 = 54 MHz
D
Q
Q
10 or 54 MHz To DAC PLL
J6, 54 MHz Input
Resistive DIvider
54 MHz To Level Detector

Figure 4-7 PFRU Board 10 MHz Reference Oscillator Circuit

4.4.7.4 PFRU Board GPS Circuit

The PFRU board includes a GPS receiver. The antenna input for the receiver is connector J8 on the PFRU board. A 50 ohm coax connects this connector to the GPS antenna input SMA connector on the modulator rear panel.

4.4.8 Up/Downconverter Board

This assembly consists of two piggy backed boards, the UDC Base and the UDC top board. The assembly has three major circuits, which are as follows:

- The Upconverter
- The Downconverter
- The Local Oscillator Distribution

4.4.8.1 Upconverter Major Specifications

Frequency bands covered:

- BIII 168 to 242 MHz

Output power is 6 dBm RMS maximum

4.4.8.2 Functional Description of Upconverter

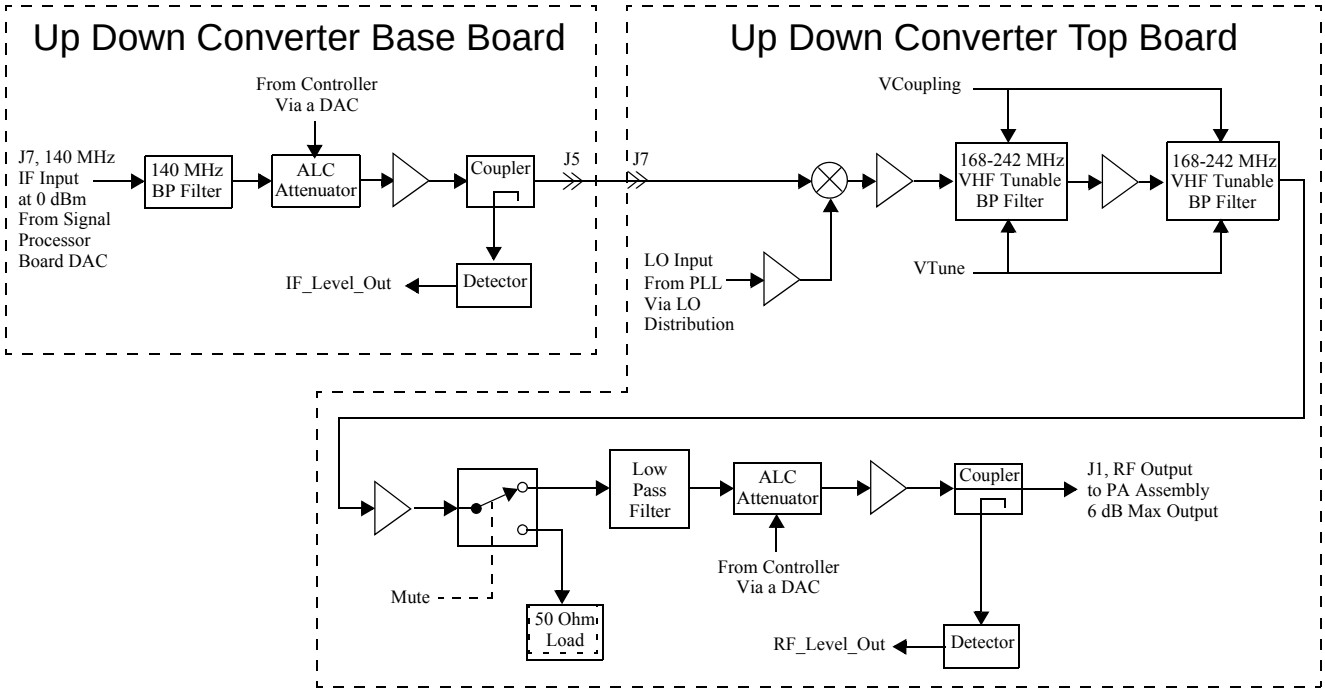


Figure 4-8 Upconverter Block Diagram

The upconverter base board accepts a 140MHz IF at a 0 dBm average level from the Signal Processing board via J7. The 140 MHz IF is filtered primarily by the low-pass portion of a bandpass filter which suppresses the unwanted DAC signals at 258MHz and above. The filtered IF is applied to a variable attenuator which is used to set the RMS level to the optimum level for the mixer in order to minimize spurious mixing products. This attenuator is set to a specific fixed value by the system controller depending on the modulation format. A directional coupler applies a sample of the IF to a detector IC, which provides a voltage output proportional to the RMS level of the IF. This voltage is A/D converted and utilized by the controller for diagnostic purposes, primarily to detect a low/missing input condition. The signal leaves the base board via J5 and is sent to the UDC top board.

The IF signal enters the UDC top board via J7. The IF is applied to the mixer through a fixed pad and a bridged T network. This provides a very good match, from DC to very high frequencies, to the IF port of the mixer which helps to minimize 3rd order mixing products, i.e. (2*IF)-LO. The mixer output is buffered by a MMIC (Monolithic Microwave Integrated Circuit) amplifier.

WARNING: Disconnect primary power prior to servicing.

The signal is next sent to a two stage VHF tunable bandpass filter, which removes the undesired mixing products. In each filter stage, the filtered RF is buffered by a MMIC amplifier.

After the filtering process the RF signal is applied to a mute circuit, which consists of a SPDT low-loss, high isolation (60dB @ 1.5GHz) microwave relay. When muted, the normal RF path is opened and the RF switched into a 50 load.

The RF is then passed through a low pass filter and then gain adjusted by a variable attenuator and sent to an amplifier. The amplifier is followed by a low-loss directional coupler with the main coupler path leaving the up converter via J1 and sent to the power amplifier assembly.

The coupled RF sample is applied to an AD8362 demodulating detector IC. The detector output is heavily low-pass filtered to provide average power measurement.

4.4.8.3 Downconverter Major Specifications

The downconverter includes two selectable RF RTAC (real time adaptive correction) input samples, which are:

- The PA output RF sample, taken before the high power mask filter
- The high power mask filter RF sample, taken after the high power mask filter.

Downconverter input specifications:

- Frequency range is 168 to 242 MHz
- Input power range is -20 to +5 dBm, with the optimum input level -5 dBm

4.4.8.4 Downconverter

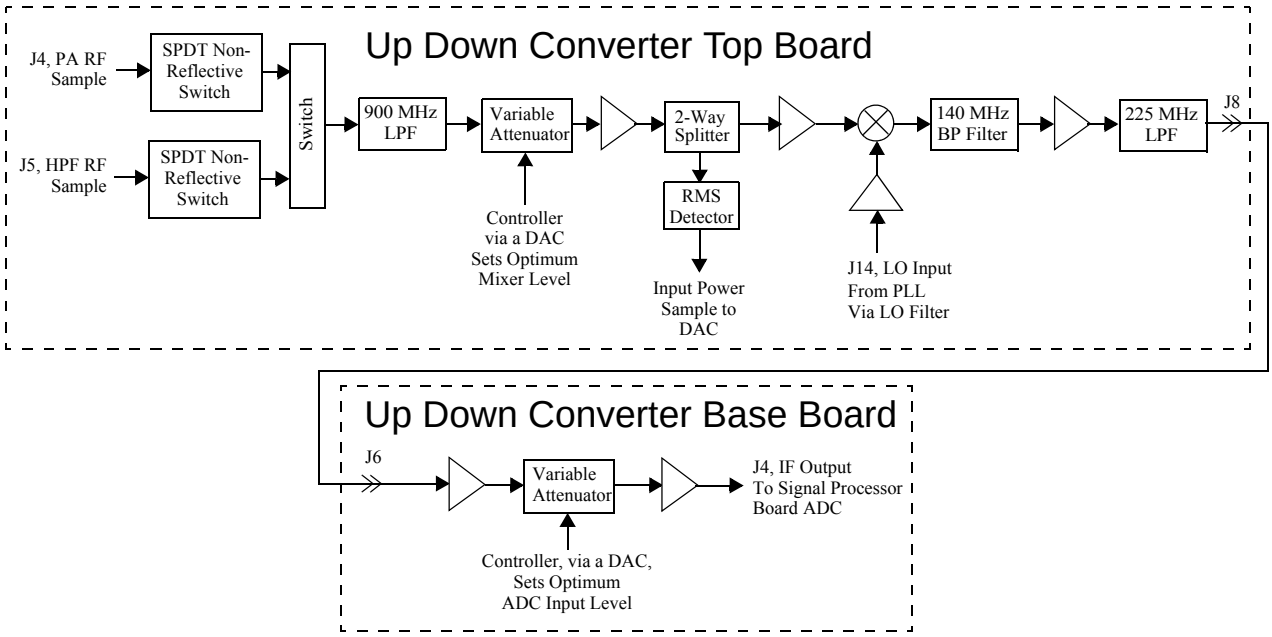

Up Down Converter Top Board
J4, PA RF Sample
SPDT Non-Reflective Switch
J5, HPF RF Sample
SPDT Non-Reflective Switch
Switch
900 MHz LPF
Variable Attenuator
Controller via a DAC Sets Optimum Mixer Level
2-Way Splitter
RMS Detector
Input Power Sample to DAC
140 MHz BP Filter
J14, LO Input From PLL Via LO Filter
225 MHz LPF
J8
Up Down Converter Base Board
J6
Variable Attenuator
Controller, via a DAC, Sets Optimum ADC Input Level
J4, IF Output To Signal Processor Board ADC

Figure 4-9 Downconverter Block Diagram

The downconverter accepts the following on-channel RF inputs:

- Transmitter system PA (pre-filter) sample for non-linear estimation.
- Transmitter system HPF (post-filter) sample for linear estimation.

The two RF sample inputs are each applied to a high-isolation two-way switch IC. The selected sample is routed through its respective two-way switch to the final 2-way selector switch, while the undesired input is switched into a resistive load. This arrangement provides very good isolation of the signals and a good absorptive match to the input in the de-selected state.

The selected RF sample is passed through a 900 MHz low pass filter and then variably attenuated, buffered, and split. One path feeds a power detector which provides a DC sample used by the controller to adjust the attenuator for optimum RF level into the mixer. The other path is amplified and applied to the mixer input. The IF output of the mixer is applied to a bridged-T network and buffered by a MMIC amplifier, then low-pass filtered with a 225 MHz Mini circuits chip low-pass filter. This filter removes unwanted mixing components from VHF conversions while being transparent to the 140MHz IF in terms of amplitude response and group delay. This IF leaves the up/

Down converter top board via J8 and is sent to J6 on the Up/Down converter base board.

In the Up/Down converter base board, the filtered IF is buffered and variably attenuated to allow the controller to optimize the level into the A/D converter in the signal processing board. A high linearity output amplifier drives the IF output to the ADC.

4.4.8.5 LO Distribution

LO (Local Oscillator) distribution is part of the up/downconverter.

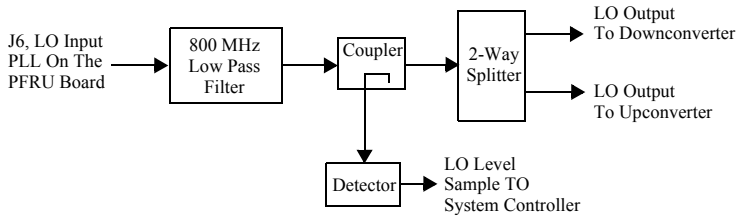


Figure 4-10 Up/Downconverter Bd, LO Distribution Circuit Block Diagram

The LO input from the PFRU is 0+/-2dBm, with harmonics of -10 to -15 dBc. It utilizes a high frequency VCO (800-1600MHz) which is divided down to provide the LO frequencies required for the Up/Down converter. For more consistent mixer performance, it is desirable to have tighter control of the LO level. The coupled output of a directional coupler is applied to a power detector. This detected output was included for diagnostic purposes, to detect a missing input condition, and was used to maintain a constant LO input level to the mixer.

A two-way splitter follows the coupler, with the two paths supplying the local oscillator signal +7dBm for the upconverter and downconverter.

4.5 VAX-C Transmitter PAs

4.5.0.1 Fault Protection

Certain fault conditions warrant immediate, hardware-invoked shut-down of the power supply and RF Drive to provide rapid system protection. Hardware comparators are used in conjunction with the CPLD to provide fast shutdown and notification to the signal processor in the event of the following fault conditions:

- Over current of any of the PA FETS
- Over voltage of the +50V power supply
- VSWR Protection in severe conditions too fast for and above the foldback threshold. This level is automatically scaled to the system power level and operating frequency (accounting for coupler response)
- Over temperature of either PA FET.

Trip levels appropriate to the system power level are automatically created. This is important in the case of the VSWR fault, where there is a frequency dependent coupler response. The system automatically determines the appropriate levels without “tweaking” or user interaction.

When any fault occurs, the CPLD latches a Fault, which turns off the 50V power supply and also pulls down the ALC attenuator control voltage on the UDC. This remove both drive and voltage to the PA as quickly as possible to minimize the risk of damage in a fault event.

4.5.0.2 RF Power Detection and Calibration

The power detection circuitry was designed to facilitate ease of initial calibration and eliminate the need for re-calibration on a change of frequency. It introduces the following features:

- A microstrip coupling structure is used to provide optimum unit-to-unit repeatability for forward and reflected power monitoring. The coupler includes 13dB attenuators which are built into both the forward and reflected output ports. These attenuators present a good return loss to the structure so that both ports may be used simultaneously while maintaining high directivity.
  The forward and reflected samples feed a switch matrix and forward and reflected detectors on the PA Interface. The signal processor can calculate required correction

factors on a change of frequency and provide reasonable accuracy without requiring re-calibration. A full two-point calibration should be performed at first turn-on at mid-band (205 MHz).

- On-board switching is performed so that the forward power sample will automatically be used as a signal source for reflected calibration. An attenuated forward sample is switched in while the system is running to establish a calibration point representing a -10dB reflection. The reflected calibration is automatically performed "in the background" by the system during forward calibration, and VSWR hardware trip points are automatically calculated and programmed for the VSWR fault comparator. This eliminates the need to perform reflected calibrations.
- Although the design intent is to allow frequency changes and maintain reasonably accurate power measurement without requiring re-calibration, the user can perform a calibration if they desire. Since the detector slopes were established in the one-time two-point calibration and are stored, re-calibration can be streamlined to a single point.
- Forward calibration can be performed while operating (this of course assumes that the end user has a well-calibrated directional coupler and a power meter connected externally). The measured high point, calculated low point (based on the stored slope) and frequency of calibration are stored in EEPROM for the new frequency of operation.

4.5.0.3 +50 VDC Power Supply Interface

An AC/DC converter is used to provide the +50VDC required by the BLF881 LDMOS devices in the PA assembly. This unit was used because it incorporates a logic-level enable function as opposed to one which which requires the AC to be switched to provide On/Off function. The PA Interface uses a 2N7002 in an open drain configuration. When turned ON the 7002 provides the ground to enable the AC/DC Converter. The AC/DC Converter has an open collector status output which is grounded when the supply is on and no faults are present. The /PS_PRESENT pin is grounded on the power supply end, with a 10k pull-up on the PA Interface, to indicate a cable connection to the supply.

Section 5 Maintenance and Alignments 5

This section contains the maintenance and alignment procedures for the Platinum VAX-C Series VHF transmitter. This includes routine maintenance, PA module replacement, PA module repair, transmitter calibration and PC Board replacement procedures.

⚠ **WARNING:**
THE SERVICE WORK DESCRIBED IN THIS SECTION MUST BE CARRIED OUT BY TRAINED STAFF ONLY.

5.1 Technical Assistance

Refer to the page *iii* at the front of the manual for further information regarding technical assistance.

5.2 PA Module Removal and Replacement

CAUTION:

TOXIC BERYLLIUM
SOME COMPONENTS IN THE PA MODULE CONTAIN TOXIC BERYLLIUM. THIS LIMITS MODULE REPAIR TO A MODULAR LEVEL CONSISTING OF PALLETS AND PC BOARDS ONLY.

HOT SURFACE
PLATINUM PA MODULES ARE DESIGNED TO HANDLE VERY HIGH TEMPERATURES AND MAY BE EXTREMELY HOT, UP TO 58^{O} F (32^{O} C) ABOVE ROOM TEMPERATURE. DO NOT TOUCH THE MODULE WITH BARE HANDS AFTER THE TRANSMITTER HAS BEEN RUNNING, ESPECIALLY IN HIGH AMBIENT TEMPERATURE ENVIRONMENTS. PROTECTIVE GLOVES CAN BE OBTAINED FROM HARRIS, PART #0990006483 OR GRAINGER ITEM #4JF36.

RADIO FREQUENCY HAZARD. *DO NOT ATTEMPT TO OPERATE THE TRANSMITTER OR AMPLIFIER WITH THE COVER REMOVED.*

5.2.1 PA Module Removal

Required Tools:

WAGO extractor tool
#1 Phillips screw driver
M7 (9/32") nut driver

The type of PA module will vary depending on transmitter model. PA and PS modules must be removed (or installed) with the transmitter turned off and unplugged.

STEP 1 Turn off the transmitter and disconnect AC power.

WARNING:
REMOVE AC POWER FROM THE VAX-C TRANSMITTER BEFORE ATTEMPTING PA MODULE REMOVAL. THERE ARE EXPOSED VOLTAGES IN THE PA SECTION THAT MAY CAUSE INJURY OR DAMAGE TO COMPONENTS IF CONTACTED.

STEP 2 Remove the four screws from the top cover on the VAX-C and slide the cover toward the rear of the unit to remove it.

CAUTION:
THE PA MODULE MAY BE HOT. ALLOW THE COMPONENTS TO COOL OR USE PROTECTIVE GLOVES TO PROTECT HANDS.

STEP 3 See Figure 5-1. Remove the two screws from the rear panel on either side of the output connector.

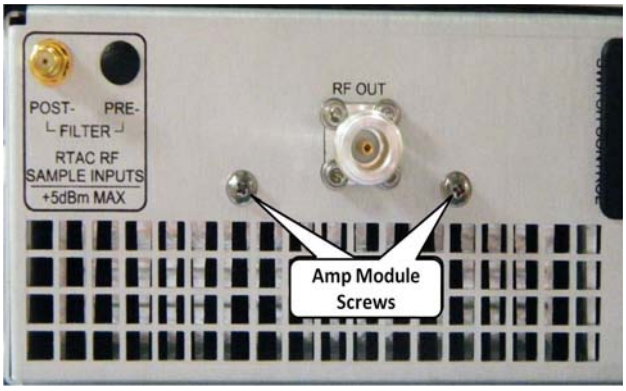


Figure 5-1 RF Output Connector

STEP 4 Remove the PA module screw from the right side of the chassis. This screw threads into the L bracket attached to the PA module heat sink.

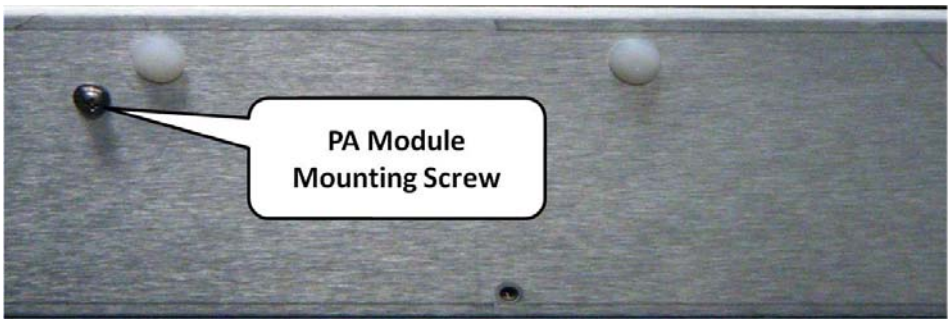


Figure 5-2 PA Module Side Mounting Screw

WARNING: Disconnect primary power prior to servicing.

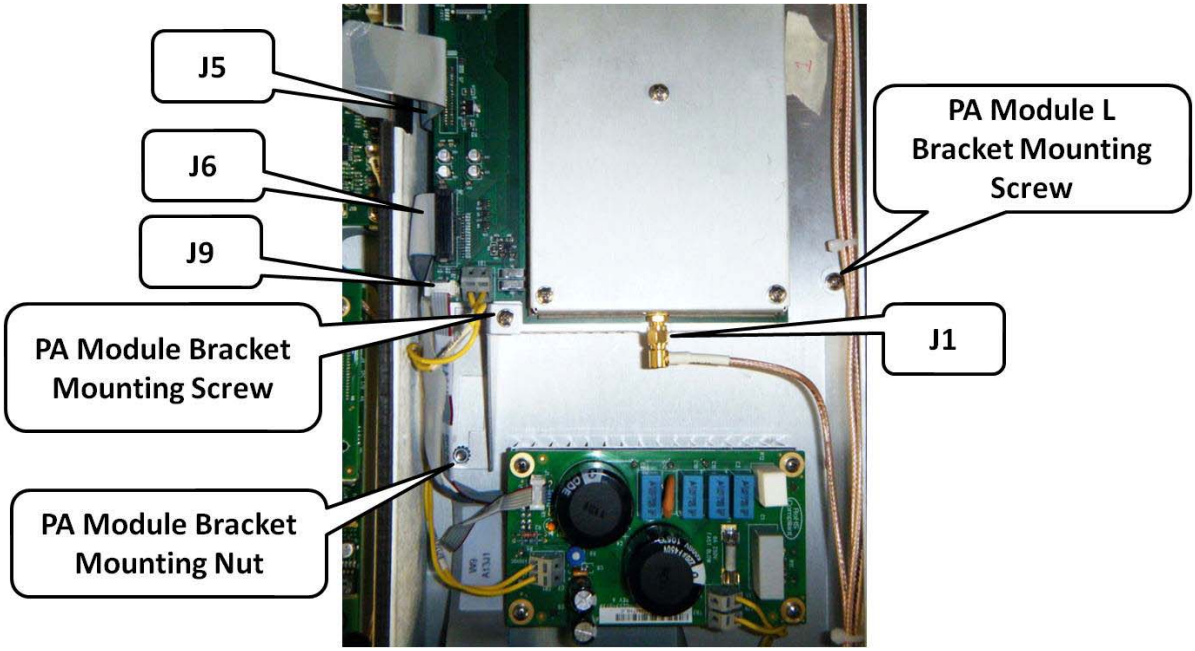


Figure 5-3 Amplifier Compartment

STEP 5 Loosen the screw that holds the L bracket to the PA module heat sink and then rotate the L bracket 90^{o} to allow maximum clearance during module removal.

STEP 6 Remove the nut (Figure 5-3) that fastens the PA module bracket to the bottom of the chassis.

CAUTION:
DO NOT DAMAGE COMPONENTS ON PA INTERFACE BOARD WHEN INSTALLING THE PA MODULE FROM THE CHASSIS.

STEP 7 Remove the RF input cable J1 from PA module front.

STEP 8 Remove the two RF connectors J3 & J4 that attach to the coupler ports.

STEP 9 Use a WAGO tool to disconnect power supply wires 54 & 55 from TB1 on the interface board.

STEP 10 Remove the W10 ribbon cable from the J9 connector on the PA interface board.

STEP 11 Remove the W9 ribbon cable from the J6 connector on the PA interface board.

STEP 12 Slide PA module toward front of chassis output until RF output connector clears the rear of the chassis.

STEP 13 Lift the PA module partially out of the chassis (tip PA interface board upward).

STEP 14 Disconnect ribbon cable W5 from J5 on the underside of the PA interface board (see Figure 5-3). The ribbon cable stays connected to the signal processor board and should be pulled out of the PA section and secured to keep it out of the way during PA module removal.

STEP 15 Remove the amplifier from the chassis.

STEP 16 End of procedure.

WARNING: Disconnect primary power prior to servicing.

5.2.2 PA Module Installation

Required Tools:

WAGO extractor tool
#1 Phillips screw driver
M7 (9/32") nut driver

NOTE:
Refer to Figure 5-3 on page 5-4 for location of components and connectors noted in the procedure below.

The type of PA module may vary depending on transmitter model. PA and PS modules must be removed (or installed) with the transmitter turned off and unplugged.

STEP 1 Turn off the transmitter and disconnect AC power.

WARNING:
REMOVE AC POWER FROM THE VAX-C TRANSMITTER BEFORE ATTEMPTING PA MODULE REMOVAL. THERE ARE EXPOSED VOLTAGES IN THE PA SECTION THAT MAY CAUSE INJURY OR DAMAGE TO COMPONENTS IF CONTACTED.

STEP 2 Remove the four screws from the top cover on the VAX-C and slide the cover toward the rear of the unit to remove it.

STEP 3 Place PA module partially into chassis with PA interface board tilted upward.

CAUTION:
DO NOT DAMAGE COMPONENTS ON PA INTERFACE BOARD WHEN INSTALLING THE PA MODULE INTO THE CHASSIS

STEP 4 Connect ribbon cable W5 to J5 on the underside of the PA interface board.

STEP 5 Position the PA module flange mounting bracket hole over the stud in the bottom of the chassis. Lower the PA module onto the transmitter chassis backplane.

STEP 6 Slide PA module toward rear of chassis until RF output connector clears the rear of the chassis.

STEP 7 Connect the W9 ribbon cable to the J6 connector on the PA interface board.

STEP 8 Connect the W10 ribbon cable to J9 on the PA interface board.

STEP 9 Use a WAGO tool to connect power supply wires 54 & 55 to TB1 on the interface board.

STEP 10 Connect the two RF connectors J3 & J4 to the coupler ports.

STEP 11 Connect the RF input cable J1 from PA module input port.

STEP 12 Install the nut (Figure 5-3) that fastens the PA module bracket to the bottom of the chassis. Leave it loose.

STEP 13 Rotate the bracket on the PA module heat sink to align the bracket with the screw hole on the right side of the transmitter chassis.

STEP 14 Install the PA module screw on the right side of the chassis. Thread this screw into the L bracket attached to the PA module heat sink. Leave it loose.

STEP 15 Install the two screws on the rear panel on either side of the output connector. Be sure the PA module output connector is fully seated in the rear chassis opening. Tighten the screws.

STEP 16 Tighten the L bracket screws, and the nut and screw holding the PA module bracket in place.

STEP 17 Check the tightness of all connectors and hardware.

STEP 18 Replace cover and tighten screws.

STEP 19 Reapply AC power.

STEP 20 End of procedure.

WARNING: Disconnect primary power prior to servicing.

5.3 PS Module Removal/Replacement

Required Tools:

Ohmmeter
WAGO extractor tool
#1 Phillips screw driver
Isopropyl alcohol
Heat sink compound or pad.
Paper towel or cloth.

STEP 1 Turn off the transmitter and disconnect AC power.

⚠ **WARNING:**
REMOVE AC POWER FROM THE VAX-C TRANSMITTER BEFORE ATTEMPTING PA MODULE REMOVAL. THERE ARE EXPOSED VOLTAGES IN THE PA SECTION THAT MAY CAUSE INJURY OR DAMAGE TO COMPONENTS IF CONTACTED.

STEP 2 Remove the four screws from the top cover on the VAX-C and slide the cover toward the rear of the unit to remove it.

STEP 3 Remove the 8A fuse and check it for continuity. If blown replace and test the transmitter to confirm operation before proceeding.

STEP 4 Use a WAGO tool to remove the yellow AC input (42 & 59 or 41 & 60 depending on version) and DC output wires (54 & 55) from the WAGO connectors on the PS board.

STEP 5 Remove ribbon cable W10 from J1 on PS board.

⚠ **WARNING:**
ONLY REPLACE FUSES WITH TYPE OF FUSE MARKED ON EQUIPMENT.

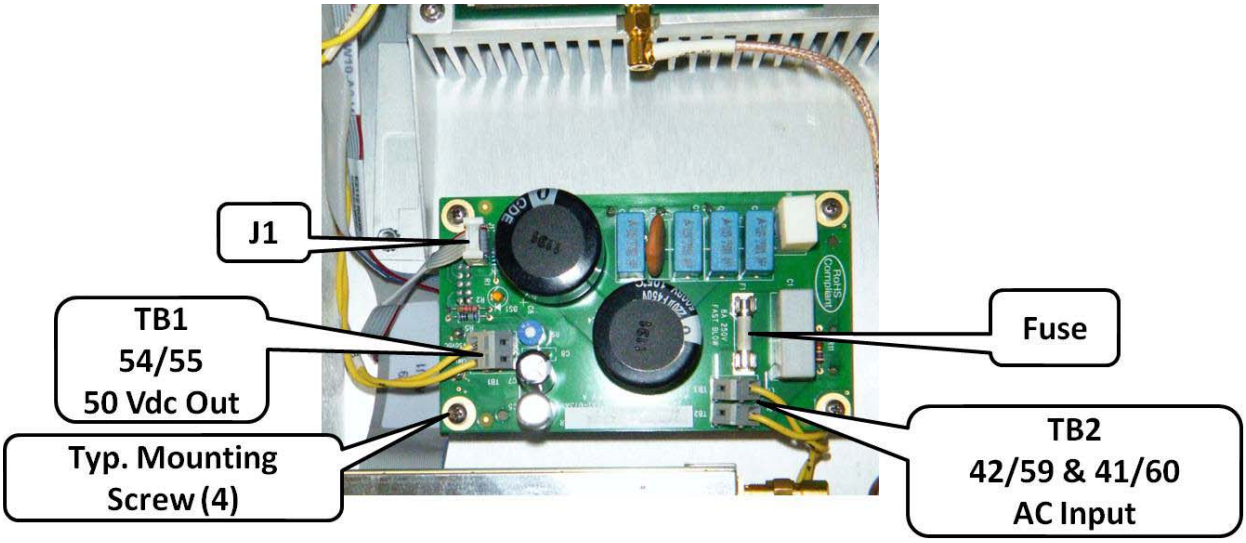


Figure 5-4 PS Module

STEP 6 Use a Phillips screwdriver to remove the four screws (one in each corner) from the PS board.

STEP 7 Lift the PS board and heatsink assembly up to remove them from the chassis.

STEP 8 Gently lift upward on the PS assembly to separate it from the heat sink.

STEP 9 Clean up the heat sink compound or pad residue on the heatsink. Use alcohol to remove completely.

STEP 10 Apply a thin, even coat of heat sink compound or a new heat sink pad to the heat sink surface.

STEP 11 Place the replacement PS module on the heatsink. Be sure to carefully align the holes in the PS module with the holes in the heatsink.

STEP 12 Install and tighten four corner screws that hold the PS and heatsink to the chassis base.

STEP 13 Use a WAGO tool to install the AC input and DC output wires.

STEP 14 Attach ribbon cable to J1. Note that the red wire in the ribbon cable goes to the pin 1 side of the connector.

STEP 15 Replace PA module cover and tighten cover screws.

STEP 16 Apply AC power.

STEP 17 End of procedure.

WARNING: Disconnect primary power prior to servicing.

5.4 Power Calibrations

NOTE:
The following calibration procedures are for digital modes.

Factory FWD/Rfld calibration has been performed during factory test at 205 MHz center frequency and the calibration is valid for the entire VHF band. Factory FWD/Rfld calibration should be required only if a PA interface board, directional coupler, or sample cable is replaced. Factory FWD/Rfld calibration is simple and can be done whenever it is deemed necessary. Simply follow the instructions given in the calibration menus.

Field Fwd/Rfld calibration can be performed as required at any operating frequency or power level to insure precision. Follow the instructions given in the Field Fwd/Rfld calibration menus.

CAUTION:
FORWARD AND REFLECTED POWER CALIBRATIONS SHOULD ONLY BE DONE WHILE OPERATING THE TRANSMITTER INTO A KNOWN GOOD LOAD SUCH AS A STATION DUMMY LOAD. BE CERTAIN THAT THE LOAD IS A CONFIRMED 50 OHMS AND HAS THE CAPABILITY TO HANDLE THE POWER THAT WILL BE GENERATED BY THE TRANSMITTER.

Power calibrations can be performed using the local LCD screen or the web browser interface. Calibration performed via web browser interface require a user login and password at the admin level. Transmitters ship from the factory with the default login "admin" and the default password "admin" (do not include quotation marks in login or password, login and passwords are case sensitive). If you change passwords be sure to retain them in a secure location. You will not be able to make changes to transmitter settings via web browser without a valid password.

Harris recommends the Firefox web browser but Chrome or IE8 (or greater) can be used as well.

Refer to Figure 3-9 on page 3-12. In the ’System Configuration’ screen select soft key ’Cal’. If logged in via web browser, the following screen (in HTML format) will be displayed to facilitate Calibration.

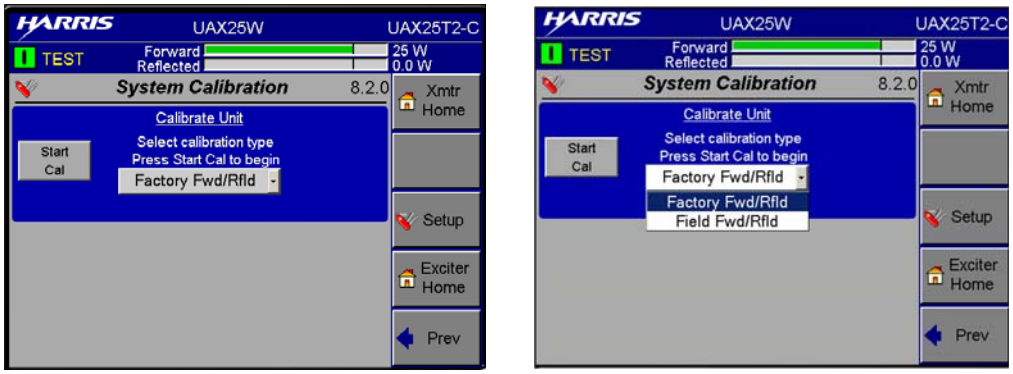


Figure 5-5 *on left* - System Calibration *on right* - System Calibration options

The procedures described below assume use of the VAX-C LCD menus screens. Power calibrations include:

- Factory Fwd/Rfld - System forward and reflected power at output of transmitter before band pass filter (BPF). Typically performed at 205 MHz.
- Field Fwd/Rfld - System forward power at output of transmitter before BPF. Typically performed at operating frequency for maximum accuracy.

Equipment Used:

- An averaging power meter (with probe) similar to the Agilent E4418B with appropriate adapters. Meter should be capable of displaying measured values in Watts or in dBm.
- Precision directional coupler (precision meaning the coupling value have been measured for the operating frequency of 205 MHz).

NOTE:
Read and understand the applicable power calibration procedure before beginning. The procedures below assume use of the LCD display and the control buttons on the front of the VAX-C. The procedure can also be performed using web browser screens. Web browser calibration screens are shown in Figure 5-5.

WARNING: Disconnect primary power prior to servicing.

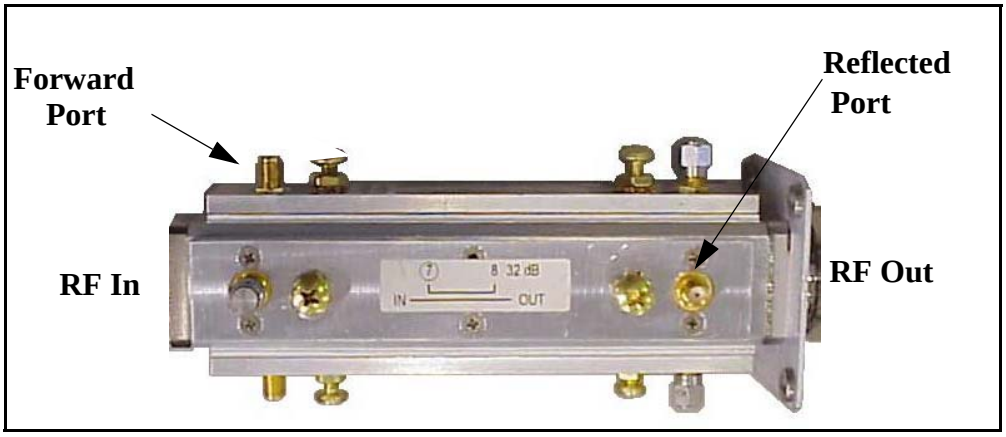


Figure 5-6
Typical Output Directional Coupler and Connections

5.4.1 System Factory Fwd/Rfld Calibration

System factory forward power is calibrated over a range of 10 dB below model power to full model power. The forward power reference sample is taken from the internal directional coupler and regulates the power of the transmitter output before any filter losses. Reflected power is automatically calculated as the calibration routine is processed. Calibration data is stored on a PA interface board EEPROM.

The system detectors utilize a linear (in mV/dB) output, so by performing the two-point calibration at 205 MHz, the detector slope and coupling factors are calculated and thus provide good accuracy over the 10%-100% power range across the VHF band.

STEP 1 Zero and calibrate the RMS power meter, following the manufacturer's procedures for that specific model.

STEP 2 Install a directional coupler at the output of the transmitter. The directional coupler must be capable of handling the rated transmitter output power and have defined coupling values to allow accurate measurements of forward power levels. A typical coupler is shown in Figure 5-6.

NOTE:
Couplers like the one shown in Figure 5-6 use one port as a coupled port while the opposite port is terminated in an external 50 ohm load. The load must be installed in order to perform accurate measurements.

CAUTION:
DO NOT APPLY EXCESSIVE DOWNWARD PRESSURE (WEIGHT) ON THE TYPE N OUTPUT CONNECTOR. IF A DIRECTIONAL COUPLER IS ATTACHED DIRECTLY TO THE OUTPUT CONNECTOR IT SHOULD BE ADEQUATELY SUPPORTED. EXCESSIVE STRESS ON THE CONNECTOR MAY CAUSE INTERNAL DAMAGE AND RESULT IN HIGH VSWR CONDITIONS THAT COULD CAUSE ARCING OR HEATING.

STEP 3 Once the coupler coupling value is determined, enter this value as a power meter off, set the meter's display to read in dBm or Watts and connect the power meter sensor to the forward coupler port.

NOTE:
The sample level present at this coupler port (TPO - coupling value) must not exceed the maximum input range of the power sensor in use.

NOTE:
Calibration must be performed with the transmitter operating into a known good load or antenna system. If reflected power rises to a level that exceeds 10% of forward power stop raising power. Turn off the transmitter and begin checking the output components (transmission line, load, antenna) for faulty components that produce high VSWR (voltage standing wave ratio) levels.

STEP 4 Connect the transmitter output to a known good load. If required, use a short, high quality, low VSWR, 50 ohm cable preferably RG-213 or better.

STEP 5 Apply AC power to the transmitter chassis.

STEP 6 Press Remote Disable on the front of the transmitter.

STEP 7 Press and hold the Power Lower button for 20 seconds to lower transmitter output power at turn on.

STEP 8 Press the transmitter ON button while monitoring transmitter forward power on the external power meter. Monitor reflected power on the LCD screen. Slowly raise the power to the desired operational power level and allow the transmitter to run for several minutes until output power is stable.

STEP 9 Compare the external power meter value with the forward power displayed on the LCD screen. If the values do not agree proceed with calibration.

STEP 10 Use the LCD screen and control buttons to navigate to the calibration menu SETUP> XMTR POWER SETTINGS> POWER CAL>

FACTORY FWD/RFLD. Press Enter one time to highlight the menu then use the up/down keys to select Factory Fwd/Rfld.

STEP 11 Start the calibration procedure by pressing the Enter button again.

STEP 12 Follow the instructions on the LCD screen and use the power Raise/ Lower buttons to adjust the transmitter output to the desired low level.When a stable reading is attained on the power meter, select Save and then press Enter.

NOTE:
It is helpful to check the RF DAC value displayed (in Hex) on the calibration screen. In a system which is properly configured and operating correctly a DAC value that exceeds 860 without reaching the desired low power level indicates a possible problem, verify the system is configured correctly.

STEP 13 Follow the instructions on the screen and use the Raise/Lower buttons to adjust the transmitter output to the desired high level. When a stable reading is attained on the power meter, select Save and then press Enter.

NOTE:
It is helpful to check the RF DAC value displayed (in Hex) on the calibration screen. In a system which is properly configured and operating correctly a DAC value that exceeds A73 without reaching the desired high power level indicates a possible problem, verify the system is configured correctly.

STEP 14 Procedure complete.

5.4.1.1 Calibration Errors

If any components in the amplifier section are faulted during the calibration, the system will consider it invalid and discard it. Replace any faulty components and perform the calibration again.

5.4.2 Field Fwd/Rfld Calibration

Field Fwd/Rfld calibration can be performed any time greater accuracy is required at any specific frequency or power level. Field calibration is a one point calibration performed at a customer specified power level and frequency. The forward power reference sample is taken from the internal directional coupler and regulates the power of the transmitter output before any filter losses. Reflected power is automatically calculated as the calibration routine is processed. Calibration data is stored on a PA interface board EEPROM.

STEP 1 Zero and calibrate the RMS power meter, following the manufacturer's procedures for that specific model.

STEP 2 Install a directional coupler at the output of the transmitter. The directional coupler must be capable of handling the rated transmitter output power and have defined coupling values to allow accurate measurements of forward power levels.

CAUTION:
DO NOT APPLY EXCESSIVE DOWNWARD PRESSURE (WEIGHT) ON THE TYPE N OUTPUT CONNECTOR. IF A DIRECTIONAL COUPLER IS ATTACHED DIRECTLY TO THE OUTPUT CONNECTOR IT SHOULD BE ADEQUATELY SUPPORTED. EXCESSIVE STRESS ON THE CONNECTOR MAY CAUSE INTERNAL DAMAGE AND RESULT IN HIGH VSWR CONDITIONS THAT COULD CAUSE ARCING OR HEATING.

STEP 3 Once the coupler coupling value is determined, enter this value as a power meter offset, set the meter's display to read in dBm or Watts and connect the power meter sensor to the forward coupler port.

NOTE:
The sample level present at this coupler port (TPO - coupling value) must not exceed the maximum input range of the power sensor in use.

NOTE:
Calibration must be performed with the transmitter operating into a known good load or antenna system. If reflected power rises to a level that exceeds 10% of forward power stop raising power. Turn off the transmitter and begin checking the output components (transmission line, load, antenna) for faulty components that produce high VSWR (voltage standing wave ratio) levels.

STEP 4 Connect the transmitter output to a known good load. If required, use a short, high quality, low VSWR, 50 ohm cable preferably RG-213 or better.

STEP 5 Apply AC power to the transmitter chassis.

STEP 6 Press Remote Disable on the front of the transmitter.

STEP 7 Press and hold the Power Lower button for 20 seconds to lower transmitter output power at turn on.

STEP 8 Use the LCD and front panel controls to navigate to SETUP>PFRU (PLL)>CENTER FREQ. (MHZ) and set frequency and offset to desired values. Press the Power menu button (below the LCD screen).

STEP 9 Press the transmitter ON button while monitoring transmitter forward power on the external power meter. Monitor reflected power on the LCD screen. Slowly raise the power to the desired operational power level and allow the transmitter to run for several minutes until output power is stable.

STEP 10 Compare the external power meter value with the forward power displayed on the LCD screen. If the values do not agree proceed with calibration.

STEP 11 Use the LCD screen and control buttons to navigate to the calibration menu SETUP> XMTR POWER SETTINGS> POWER CAL> FIELD FWD/RFLD. Press Enter one time to highlight the menu then use the up/down keys to select Field Fwd/Rfld.

STEP 12 Start the calibration procedure by pressing the Enter button again.

STEP 13 Follow the instructions on the LCD screen and use the power Raise/Lower buttons to adjust the transmitter output to the desired level.When a stable reading is attained on the power meter, select Save and then press Enter.

NOTE:
It is helpful to check the RF DAC value displayed (in Hex) on the calibration screen. In a system which is properly configured and operating correctly a DAC value that exceeds A775 without reaching the desired power level indicates a possible problem, verify the system is configured correctly.

STEP 14 Procedure complete.

5.4.2.1 Calibration Errors

If any components in the amplifier section are faulted during the calibration, the system will consider it invalid and discard it. Replace any faulty components and perform the calibration again.

5.5 Pre-correction for Digital TV & DAB

Digital transmitters are typically operated in adaptive nonlinear predistortion and linear equalization mode. The precorrection and equalization are applied in the modulator section (exciter). The procedure described below will automatically calculate the precorrection for an installed system. Once the precorrection has been calculated, it can be stored in the setup memory for later use in Stored mode. The precorrection is normally applied by setting both the Linear and Nonlinear RTAC mode to ADAPT.

Assumptions:

- Transmitter average power level is known
- An signal sample is available from a forward coupler after the amplifier and prior to the mask bandpass filter. This sample is inside the VAX-C chassis.
- A signal sample is available from a forward coupler after the mask bandpass filter.

Equipment and Tools Required:

- Spectrum or TV analyzer

5.5.1 Precorrection Setup Procedure

Nonlinear Predistortion:

STEP 1 With the transmitter operating at the desired power level, set the nonlinear RTAC mode to ADAPT via the POWER menu on the VAX-C front panel LCD display or by using the VAX-C web browser to navigate to Exciter Home > Setup > DUC/RTAC screen.

STEP 2 Verify that the nonlinear RTAC attempt and success counters increment about every 20 seconds on the Exciter Home > Setup > DUC/RTAC screen.

STEP 3 Use a spectrum analyzer to measure the adjacent-channel IMD shoulder levels. Verify compliance with any prevailing spectrum mask requirements.

STEP 4 Save this current nonlinear correction in one of the four slots (See Storing Precorrection Section 5.5.2).

NOTE:
If the Linear RTAC section is in BYPASS at this time, linear correction will not be stored.

Linear Equalizer:

STEP 5 Set the linear RTAC mode to ADAPT via the POWER menu on the VAX-C front panel LCD display or by using the VAX-C web browser to navigate to Exciter Home > Setup > DUC/RTAC screen.

STEP 6 Verify that the linear RTAC attempt and success counters increment about every twenty seconds.

STEP 7 Use a TV analyzer to measure the MER (DVBT, DAB) or EVM (ATSC).

STEP 8 Save this current linear correction in one of the four slots (See Storing Precorrection Section 5.5.2).

STEP 9 Procedure complete.

5.5.1.1 Troubleshooting Precorrection

If the RTAC mode are set to ADAPT, but the Attempts counter does not increment within thirty seconds, there is a problem with the feedback samples.

Check the signal levels at the PRE and POST-FILTER inputs on the back of the VAX-C. They should be between -10dBm and +5dBm (optimum is 0dBm at the inputs on the back of the VAX-C).

Check the RTAC levels on the VAX-C STATUS > RTAC GUI screen. The bar meters should be green and the level should be just below the black 100% line.

Check that the exciter Home Screen shows ON in the upper left corner of the GUI screen. If the exciter is OFF or MUTE, the corrections cannot be calculated.

5.5.2 Storing Precorrection

Follow this procedure to store the calculated RTAC correction values to VAX-C memory.

STEP 1 Go to the RTAC - Stored Correction sets Screen, Figure 5-7.

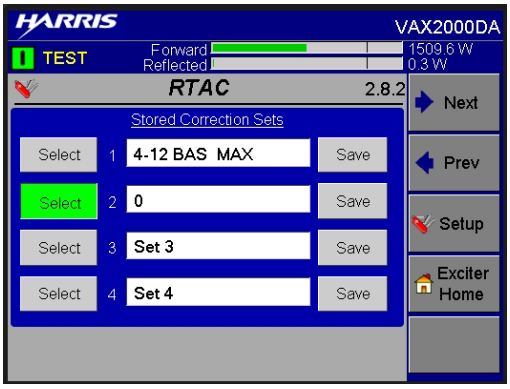


Figure 5-7 RTAC Stored Correction Sets Screen

STEP 2 Enter a name of up to sixteen characters for the desired set.

STEP 3 Press the SAVE button to store the correction to memory.

NOTE:
The correction currently being applied will be stored, overwriting any values previously stored in memory.

WARNING: Disconnect primary power prior to servicing.

5.6 Changing Frequency

This procedure describes manual change of the channel frequency to a new value. Save the settings on the initial channel before proceeding with frequency change. Once operation on the new frequency has been established, a second set of settings should also be saved. This will greatly facilitate changing between frequencies in the future by simply duplicating the previously recorded settings. The settings can be saved using the web browser and navigating to Tx Home>Exciter Home>Setup>ISP>Save Settings.

This discussion assumes that the frequency will be changed manually and somewhat infrequently.

Required Tools:

- Spectrum Analyzer
- Network Analyzer (use for re-tuning of output filter and determination of coupling values)
- Directional coupler and average power meter or other precision power measurement means. This is only required if the user would like to do a power calibration at the new frequency, but it is not required.

CAUTION:
COAXIAL DIRECTIONAL COUPLERS MAY NOT BE COMPENSATED VERSUS FREQUENCY. THAT IS, THEY WILL EXHIBIT A MONOTONIC RISE IN COUPLING VALUE ACROSS THE VHF BAND. ACCORDINGLY, ANY COUPLING VALUES WRITTEN ON COUPLER PORTS MAY NOT BE APPLICABLE TO A NEW OPERATING FREQUENCY. CONSULT COUPLER FACTORY TEST DATA SHEETS (IF FURNISHED) OR RE-MEASURE THE COUPLER WITH A NETWORK ANALYZER TO DETERMINE THE COUPLING VALUES AT THE NEW FREQUENCY.

The caution above does not apply to internal VAX-C power measurements, which are frequency compensated.

Procedure:

STEP 1 Turn off transmitter via OFF button on VAX-C front panel.

STEP 2 Use the LCD and front control buttons to navigate to POWER>LINEAR and select BYPASS. Then navigate to POWER>NONLINEAR and select BYPASS.

STEP 3 Tune output filter (if present) to new frequency. Consult filter test data, specification sheet, or other manufacturer-supplied information for more details. Some output filters are band limited and may not be adjustable across the VHF band. In cases where the filters are band limited a replacement filter will be required.

WARNING:
HARRIS DOES NOT RECOMMEND FIELD TUNING OF FILTERS. CONSULT THE MANUFACTURER OF THE FILTER BEFORE ATTEMPTING ANY FREQUENCY TUNING OF FILTERS. HARRIS RECOMMENDS ACQUIRING A FILTER TUNED TO THE FREQUENCY OF CHANGE BEFORE PROCEEDING WITH A FREQUENCY CHANGE.

STEP 4 Use network analyzer to confirm performance of test load, filter, transmission line and antenna at new frequency.

STEP 5 Use the LCD and front control buttons to navigate to the SETUP >PFRU>CENTER FREQUENCY menu and enter the new frequency (MHz). Example: if the desired frequency is 500.5, MHz enter ’500’ as the center frequency and enter the FREQUENCY OFFSET value as "500000" (Hz). If the web browser is being used navigate to Tx Home>Exciter Home>PFRU>Frequency (MHz) and enter the value as a whole number and decimal. Example: if the desired frequency is 500.50 MHz select the white Frequency box, it will turn light yellow, and then type in the new value 500.5 and press the enter key. A confirmation box will open to ask "Are you sure? Press the OK button to proceed.

STEP 6 Press the power down button for 40 seconds.

STEP 7 Use the LCD and control buttons to navigate to SETUP>XMTR>POWER SETTINGS menu. Adjust the power settings in this menu to the new levels.

STEP 8 Turn transmitter on.

NOTE:
Steps 9-11 are not absolutely required, the system run at the new desired frequency and will be very close to the desired TX power. If you desire to calibrate the system follow step 9-11.

STEP 9 Use a calibrated, averaging power wattmeter and a directional coupler (with known coupling factor) to measure and monitor the transmitter output power.

STEP 10 Slowly raise the transmitter power (using the raise button) until the desired power reading is observed on calibrated power meter connected to directional coupler at transmitter output (or at the front panel on some models).

STEP 11 Navigate to the SETUP>XMTR POWER SETTINGS>POWER CALIBRATION MENU. Select FIELD FWD/RFLD and perform calibration.

STEP 12 With transmitter set to nominal power output use power meter to confirm RTAC sample level (-5dBm optimal).

STEP 13 Use the LCD and front control buttons to navigate to POWER>LINEAR and select ADAPT. Then navigate to POWER>NONLINEAR and select ADAPT.

STEP 14 Confirm signal quality.

STEP 15 Procedure complete.

5.7 Fan Replacement

There are two 12Vdc fans on the front of the Platinum VAX-C. The fans can be replaced while the transmitter is on air.

STEP 1 Loosen the two screws that attach the VAX-C front panel to the chassis.

STEP 2 Remove the front cover to expose the two fan assemblies.

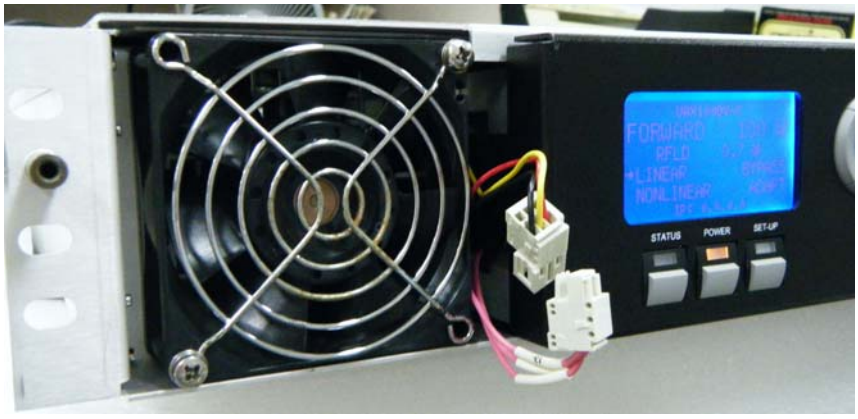


Figure 5-8 VAX-C Fan Connection

STEP 3 Unplug the connectors that supply DC to the fan. The unplugged connectors are shown in Figure 5-8.

CAUTION:
THE FANS MAY CONTINUE TO ROTATE FOR SEVERAL SECONDS AFTER REMOVAL. FANS WILL START UP AS SOON AS THEY ARE PLUGGED IN.

STEP 4 Remove the fan mounting screws and the fan assembly.

STEP 5 Place the new fan in position, then install and tighten the mounting screws.

STEP 6 Reconnect the connectors that supply DC to the fan. The fan will immediately begin rotating if the power is on.

STEP 7 Replace the VAX-C front panel assembly and tighten the two mounting screws.

STEP 8 End of procedure.

5.8 Air Filter Replacement

Monthly inspection and cleaning of the air filter is recommended. Clean filters more often in dusty environments. The filters can be easily removed from the front panels and then cleaned. The filter must be thoroughly dry before reuse. The part number for the filter material used in the VAX-C is 061-0115-000. The filter material is 1/4" thick, 10ppi.

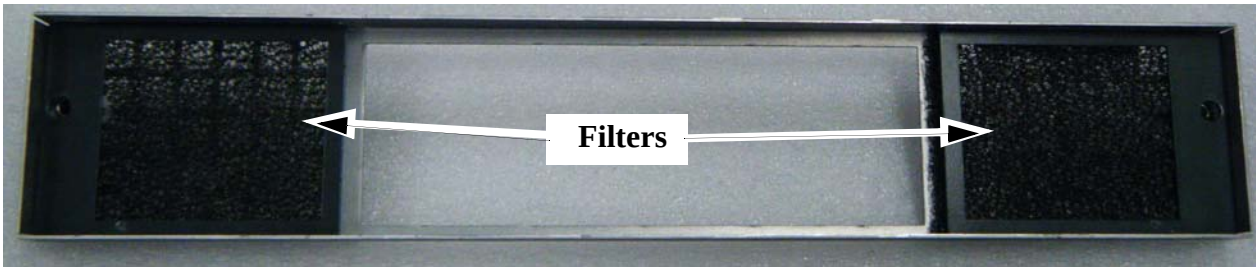


Figure 5-9 Filter in VAX-C Front Panel

STEP 1 Loosen the two front panel connectors and remove the front panel. The two filters are captive inside the front panel and slide toward the center for removal.

STEP 2 Remove the filter material. The notch in the filter material aligns with the fasteners on the front panel. The filter must be re-installed with the same orientation.

STEP 3 Clean filter material with compressed air or wash with detergent & water, or replace as necessary.

⚠ **CAUTION:**
DRY THE FILTER MATERIAL THOROUGHLY BEFORE REINSTALLATION.

STEP 4 Reinstall by reversing the order of the above steps.

5.9 Cleaning

Occasionally the VAX-C circuit boards should be cleaned. All precautions against static should be observed. The technician should be grounded, either through conductive shoes or through a static ground strap.

The VAX-C should be powered down and disconnected from AC mains power before the cleaning process is started. A vacuum cleaner should be used to remove dust from the assemblies. A natural bristle brush with a metal band (needed to ground static electricity) and a wooden handle can be used to dislodge dust. A vacuum cleaner hose can develop static due to the air rushing through the hose. The hose should have a metal nozzle, which should be grounded.

Do not use compressed air to blow dirt from the VAX-C because the dirt will settle on something else. Fast moving air could damage or dislodge delicate circuit board components, and it could also cause static problems.

5.10 Changing Date and Time Battery

STEP 1 Remove power from the VAX-C.

STEP 2 If the VAX-C is installed in a rack, remove it and place on bench.

STEP 3 Remove the top cover.

STEP 4 Remove the old battery and insert a new battery with positive side toward clip.Battery slides out from under the clip. See Figure 5-10 for battery location.

NOTE:
Dispose of battery properly. Follow applicable local regulations.

STEP 5 Replace the top cover of the VAX-C and remount in transmitter. Continue on to the next section to set the time and date.

- The Harris part number for the date and time battery is 660005400 (lithium, 3V, CR2032, 20mm).

)

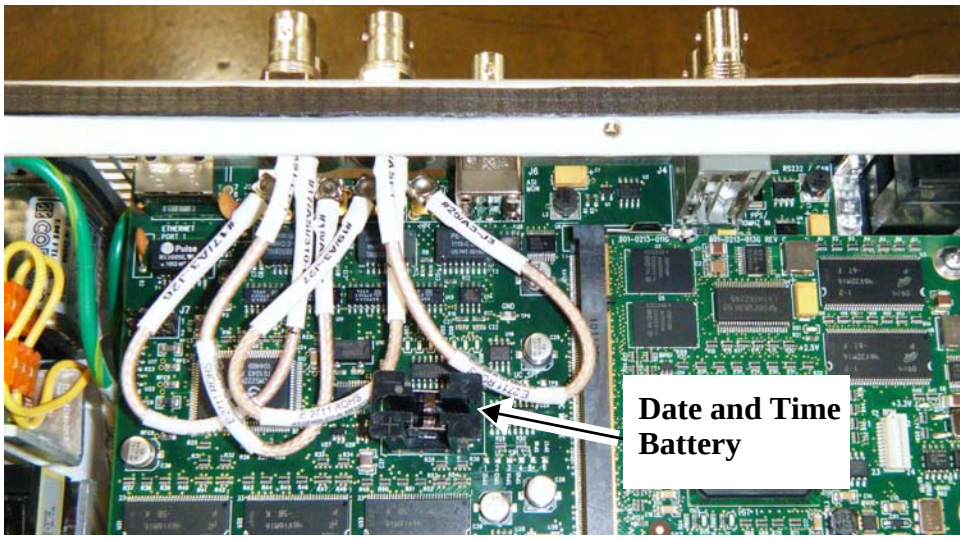


Figure 5-10 Date and Time Battery Location

WARNING: Disconnect primary power prior to servicing.

5.10.1 Setting VAX-C Date and Time

The VAX-C date and time should be set after the date and time battery is installed. The date/time can be set using either the web browser or the LCD screen and control buttons. Use the following procedure to set the date and time using the web browser.

STEP 1 Use the web browser to log into the VAX-C using the front or rear ethernet connectors.

STEP 2 Navigate to Tx Home>Exciter Home>Setup>System Settings>Next. To manually set time and date select None as UTC Source. If the transmitter is attached to a network NTP settings can be selected that will automatically set the time. If a GPS is connected the GPS time can be used to set the time.

STEP 3 Set the time and date by clicking in each box.

a. A keyboard will appear. Type in the value for that box, then press enter.

b. Repeat step A for each box.

c. The time is entered in the 24 hour format.

d. This screen does not indicate the correct time. Correct time and date are indicated in the Status > Signal Processor screen.

5.10.2 Battery Backup (UPS) Option

The following procedure describes installation of the VAX-C Battery Backup (UPS) option 9710051012G. The battery backup board described is compatible with the 9710051011G ASM-Power Module which contains the 901-0215-241G PWA, LVPS Distribution board.

The battery backup (UPS) option is useful in systems that require synchronized timing as in SFN networks. The UPS battery pack keeps modulator section operational for one minute and holdover components (clock oven and the GPS receiver) operating for approximately 15 minutes if the batteries are fully charged.

The battery backup (UPS) can be disabled during shipment or storage by installing a connector/jumper as shown in Figure 2-6 on page 2-19.

WARNING: Disconnect primary power prior to servicing.

Figure 5-11 Battery Backup (UPS) Location

The optional battery backup kit 9710051012G includes:

- Qty 4, 3020803006, Screw, Mach M3-0.5 X 6 SEMS
- Qty 1, 6600179000, PWA, 9.6V Battery Pack

Instructions:

STEP 1 Turn off transmitter.

STEP 2 Disconnect AC mains power from the VAX-C chassis.

⚠ **WARNING:**
REMOVE ALL POWER TO THE VAX-C BEFORE PERFORMING THE FOLLOWING PROCEDURE.

⚠ **CAUTION:**
FOLLOW APPROPRIATE ESD (ELECTROSTATIC DISCHARGE) PROCEDURES TO PREVENT DAMAGE TO SENSITIVE ELECTRONIC COMPONENTS WHEN HANDLING CIRCUIT BOARDS.

STEP 3 If the unit is not mounted in a rack proceed to step 4. If rack mounted the VAX-C must be removed from the rack. Remove cables from the back of the transmitter using a 5/16” (8mm) open end wrench and a small

straight slot screwdriver. Remove the VAX-C front cover and remove the four Phillips screws that hold the VAX-C in the rack. Slide the VAX-C out of the rack and place it on a sturdy table or bench.

STEP 4 Remove the four Phillips screws on the top, rear of the VAX-C that secure the cover chassis. Remove the cover by sliding it toward the rear of the VAX-C and lifting it upward.

STEP 5 Be sure that the connector on the back of the battery backup board aligns and seats properly on the power supply board connector. The power supply board standoffs are located on the front left side of the VAX-C.

STEP 6 Install the battery backup board and tighten the four Phillips mounting screws. The battery backup board, standoffs, and mounting screws are shown in Figure 5-11.

STEP 7 Replace the VAX-C cover and tighten hardware.

STEP 8 If rack mounted, slide the VAX-C into the rack.

STEP 9 Reconnect all cables to the rear of the VAX-C and tighten connectors as required.

STEP 10 Restore AC mains power to the VAX-C.

STEP 11 If dual VAX-Cs are used switch the Drive Control to Auto.

NOTE:
Operation of the battery backup board can be monitored on the VAX-C Battery Backup GUI screen. Refer to the VAX-C technical manual Section 3.11.5 for a detailed description of the Battery Backup status screen.

STEP 12 End of procedure.

5.11 Changing Feature Key

The feature key unlocks optional features or other modulation standards. It is an alpha-numeric number. Changes to the feature key are only needed if additional features or modulation standards are purchased. Contact your Harris sales representative for a quotation. A new feature key is not required to reload existing software or to load an updated version of existing software.

Changing modulation type, adding GPS, SFN or MH options require new feature keys. The LCD control panel on the VAX-C can't be used to enter a new feature key. The feature key must be installed using the web GUI. The GUI screen containing the feature key is shown in Figure 3-25 on page 3-41.

In order to purchase a new feature key the user must provide Harris with the front MAC address from the VAX-C(s) being updated. The front MAC address can be found on the Remote Communications web browser GUI screen shown in Figure 3-22 on page 3-37.

The new feature key is activated after the VAX-C transmitter is rebooted. Rebooting can be accomplished by disconnecting and then reconnecting AC power or by using the web browser to navigate to the Tx Home>Exciter Home>ISP page and pressing Reset.

5.12 Connecting To The VAX-C

This section describes connection to the VAX-C with a PC (Windows XP operating system) via ethernet for setup, operation, and software downloads.

NOTE:
Harris recommends the Firefox browser for use with this transmitter but Internet Explorer version 8.0 or later can also be used.

Use of IE version 8.0 or higher may require a change in the IE8 Compatibility View Settings screen. Open the IE8 browser and select Tools>Compatibility View Settings and configure the settings as shown in Figure 5-12.

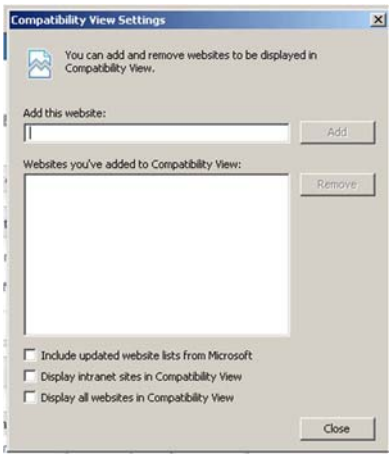

Compatibility View Settings
You can add and remove websites to be displayed in Compatibility View.
Add this website:
Add...
Websites you've added to Compatibility View:
Remove
Include updated website lists from Microsoft
Display intranet sites in Compatibility View
Display all websites in Compatibility View
Close

Figure 5-12 IE8 Compatibility View Settings

5.12.1 VAX-C Front and Rear RJ45 Connectors

The Front RJ45 Connector - VAX-C front RJ45 Ethernet connector has a fixed (static) IP address which is 192.168.117.88 The front RJ45 connector of the VAX-C is intended for direct connection to a computer which is operated in the DHCP (Dynamic Host Configuration Protocol) client mode. The front connector is driven by a DHCP server which will automatically provide a proper IP address to a directly connected computer (operated in the DHCP client mode). This address will be 192.168.117.yyy, where yyy ranges from 129 to 135.

When connecting to the VAX-C front panel ethernet port, if the computer being used does not auto-detect for cross connection, a crossover cable must be used to connect the

VAX-C front ethernet port to the computer. For additional information see "5.12.4 Connection Via Front Ethernet Connector" on page 5-34.

CAUTION:
DO NOT CONNECT THE VAX-C'S FRONT RJ45 CONNECTOR TO A NETWORK BECAUSE THE DHCP SERVER IN THE VAX-C WILL CONFLICT WITH THE DHCP SERVER IN THE NETWORK.

The rear RJ45 connector - VAX-C rear RJ45 Ethernet connector can operate in the DHCP client mode or with a static IP. It is intended for connection to an Ethernet network which is serviced by a DHCP server. That Ethernet network will supply the VAX-C rear connector with an appropriate IP address when it is in the DHCP client mode. For additional information see "5.12.5.2 Direct Connection, Computer To VAX-C Rear Ethernet Connector" on page 5-38.

NOTE:
DHCP Client Mode Computer: A computer operated in the DHCP client mode will be assigned an IP address if connected to a network or device which is configured as a DHCP server.

NOTE:
Static Mode Computer: A computer operated in the static mode has a fixed IP address and will not accept a new address offered by a DHCP server driven network. To connect a Static Mode set computer to the rear connector, the computer IP address must be within the DHCP range and must be an otherwise unused IP address. See "5.12.5.2 Direct Connection, Computer To VAX-C Rear Ethernet Connector" on page 5-38.

5.12.2 Log- In Authorization Levels & Passwords

When the Ethernet connection is established to the VAX-C, three levels of login are available. They are:

- Two "Secure" level logins, Engineer1 and Engineer2, which allow full access to the VAX-C programming functions.
- One "Administrator" level login that allows the administrator to view and change existing passwords.
- Multiple "Monitor" level logins, which allow viewing only and does not allow programming or attribute setting.

Table 5-1 Default Passwords

User Level	Username	Password
Engineer1	admin	admin
Engineer2	user2	pass2
Administrator	netadmin	harris
Monitor	-	-

5.12.3 Changing Passwords

VAX-C Usernames, Passwords and Session Time Out duration can be changed using the Tx Home>Exciter Home>Setup>User Settings>Active User screen. Login to the VAX-C using the netadmin username and password is required to access the User Management screen.

NOTE:
The netadmin login is an administrative login used to change engineer level usernames/passwords and session time out. Changes to other transmitter parameters are not allowed using the netadmin login.

After VAX-C administrator login navigate to Tx Home>Exciter Home>Setup>User Settings>Active User screen. The Active Users screen in Figure 5-13 on left will be displayed. Pressing Edit will display the NetAdmin - User Management screen (see Figure 5-13 on right). The screen shows the current usernames and passwords. Engineer 1 and 2 usernames/passwords a can be changed by typing the new names in the boxes to right.

The NetAdmin username and password can’t be changed at this time.

Values of Session Time Out from zero to 1440 minutes can be also set here (15 minutes is a typical setting). If zero is entered there is no limit on time out as long as the user requests data more frequently than every 5 minutes. If data is not requested within the five minute window then log out occurs automatically. If a value from 1-1440 minutes is entered then logout occurs automatically after that time value is exceeded.

If a browser session is closed or a network interruption occurs then the user will be logged out after 5 minutes. During the 5 minute period no user can log in using the same password.

WARNING: Disconnect primary power prior to servicing.

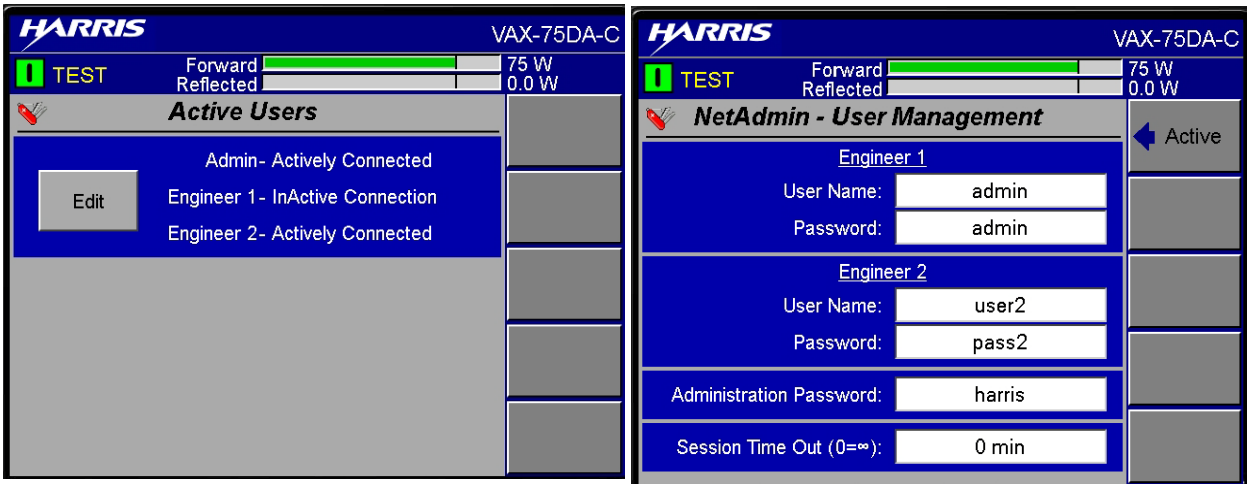


Figure 5-13 NetAdmin Active Users Screen NetAdmin - User Management Screen

Once the desired changes have been made to the NetAdmin-User Management screen press the Active button to return to the Active users screen where the current connection information is provided. Access to other screens is not allowed while logged in as an administrator. If access to other screens is desired the user must Logout and then Login as an engineer.

5.12.4 Connection Via Front Ethernet Connector

When connecting to the VAX-C front panel RJ45 connector, the connecting computer can be setup as a DHCP client, where the DHCP server associated with the VAX-C front RJ45 port will assign an address to the computer. This method of obtaining a computer address is described in Section 5.12.4.1.

The computer can also be set to Static IP mode, where its address must be assigned manually. In this mode, the address must be assigned as 192.168.117.yyy, where yyy is any value between 2 and 254, except 88.

When the computer has been assigned an IP address, connect to the VAX-C using the procedure in Section 5.12.4.3.

When connecting to the VAX-C front panel ethernet port, if the computer being used does not auto-detect for cross connection, a crossover cable must be used to connect the VAX-C front ethernet port to the computer.

5.12.4.1 Assigning Computer IP Address in DHCP Client Mode

If the computer is in the DHCP client mode, it will automatically obtain an address from the front panel RJ45 (Ethernet) connector. Use the following procedure to obtain an address for the computer. To avoid reboot of the computer refer to Section 5.12.4.2 for an alternate method.

STEP 1 Connect an ethernet cable between the computer's RJ45 connector and the VAX-C front panel RJ45 connector.

STEP 2 Reboot the computer. The computer's address should now be 192.168.117.yyy, where yyy ranges from 129 to 135.

STEP 3 It should be possible to connect to the VAX-C using the procedure in 5.12.4.3 .

If this procedure fails to assign a compatible IP address to the PC, use the procedure listed below at 5.12.4.2 on page 5-35.

5.12.4.2 Assigning Computer IP Address Without Rebooting

STEP 1 Connect an ethernet cable between the computer's RJ45 connector and the VAX-C front panel RJ45 connector.

STEP 2 Press Start > Run.

STEP 3 The Run window should open.

STEP 4 The run window open box should display 'cmd'. If not, type 'cmd', then press OK.

STEP 5 The cmd.exe window will open.

STEP 6 Type in 'ipconfig /release', then hit enter.

a. This will disassociate the computer from the previous ethernet network to which it was connected.

STEP 7 Type in 'ipconfig /renew', then hit enter.

a. This associates the computer with the VAX-C front panel RJ45 ethernet connector.

b. The VAX-C will assign an address to the computer, which is 192.168.117.yyy, where yyy ranges from 129 to 135.

STEP 8 To verify the new address type in 'ipconfig /all', then hit enter.

WARNING: Disconnect primary power prior to servicing.

a. The new IP computer ethernet address should be set.

STEP 9 Connect to the VAX-C using the procedure in 5.12.4.3 .

To reconnect to another Ethernet network, connect the computer to the desired network and perform either of the above procedures.

5.12.4.3 Making the Connection to the VAX-C

STEP 1 Connect an ethernet cable between the computer's RJ45 connector and the VAX-C front panel RJ45 connector.

a. If the computer being used does not auto-detect for cross connection, a crossover cable must be used to connect the VAX-C front ethernet port to the computer.

b. If necessary perform the DHCP procedure found in "5.12.4.1 Assigning Computer IP Address in DHCP Client Mode" on page 5-35 or "5.12.4.2 Assigning Computer IP Address Without Rebooting" on page 5-35.

STEP 2 Open Mozilla Firefox and enter the VAX-C's front connector address: (192.168.117.88).

STEP 3 The Log In Screen should appear.

STEP 4 Log in using user name and password.

a. The default user name and password for Engineer1 is admin, admin. Provisions to change the login user names and passwords are given in 5.12.2 .

STEP 5 The VAX-C web GUI is now displayed and can be navigated as needed.

5.12.4.4 Obtaining Rear Ethernet Connector Address

The VAX-C rear RJ45 connector should have already been connected to the existing ethernet.

Connect a computer to the VAX-C front panel RJ45 connector and log in as described above.

STEP 1 Navigate, on front panel LCD to the Setup > Communications Tab.

STEP 2 The rear panel Ethernet connector address will be given on this page in the Ethernet #2 sub window.

STEP 3 The Ethernet #1 window gives the front Ethernet parameters.

5.12.5 Connecting Via VAX-C Rear Panel Ethernet Connector

Two methods are used to connect to the rear panel RJ45 connector, they are as follows:

- Connecting through an existing ethernet network.
- Direct connection, computer to VAX-C rear RJ45 connector.

Both of these connection methods are described below.

5.12.5.1 Connecting To VAX-C Via Existing Ethernet Network

When connecting to an VAX-C through an existing ethernet network, the connecting computer can be setup on static IP if it has already been assigned an address on the network in question. If it has not already been assigned an address on that network, it must be setup as a DHCP client so the network can assign it an address.

STEP 1 Connect the VAX-C rear RJ45 connector to the existing ethernet network.

STEP 2 Connect the computer to a connector on the existing ethernet network.

STEP 3 Go to Internet Explorer and type the VAX-C rear RJ45 connector address found in "5.12.4.4 Obtaining Rear Ethernet Connector Address" on page 5-36.

STEP 4 Log In Screen should appear.

STEP 5 Log in using user name and password.

STEP 6 The VAX-C web GUI is now displayed and can be navigated as needed.

NOTE:
Some network switches utilizing secure connections will require the MAC address to be given to the switch to allow traffic to pass to and from it. The MAC address can be found just above the IP address Field.

5.12.5.2 Direct Connection, Computer To VAX-C Rear Ethernet Connector

Direct connection to the VAX-C's rear RJ45 connector is not recommended, but it can be done. The front panel, with its DHCP server is recommended for direct connection.

When directly connecting a computer to the VAX-C rear panel ethernet connector, the connecting computer must be setup on Static IP mode with the first three segments of its address set the same as the first three segments of the address of the rear connector of the VAX-C. **For example**, assume the VAX-C rear panel address is 137.237.242.138. The computer address must be set to 137.237.242.yyy, where yyy is any number below 255, excluding 138 and 0. In other words, the Static IP address must be within the DHCP range and must be an otherwise unassigned IP address.

Direct connection to the rear panel by a computer set to the DHCP client mode **may** work if both had been connected to the same network. This assumes the DHCP assigned IP address has not changed.

STEP 1 Connect an ethernet cable between the computer and the VAX-C rear panel RJ45 connector.

STEP 2 Go to Internet Explorer and type the rear RJ45 connector address. Using the example given above, the rear connector address will be 137.237.242.138

STEP 3 Log In Screen should appear.

STEP 4 Log in using user name and password.

STEP 5 The VAX-C web GUI is now displayed and can be navigated as needed.

5.12.6 Changing PC Operating Mode Static/DHCP

STEP 1 Connect an ethernet cable between the computer and the VAX-C rear panel RJ45 connector.

STEP 2 On the computer, click Start > Settings > Network Connections. The network connections window will appear.

STEP 3 In the network connections, right click on the network connections soft key, a drop down list will appear.

STEP 4 From the drop down list, select properties. The Local Area Connection Properties window will appear.

STEP 5 In the local area connection properties window, scroll down in the sub window until the Internet Protocol (TCP/IP) selection appears.

STEP 6 Click on the Internet Protocol (TCP/IP) selection.

STEP 7 Click on the Properties soft key below and to the right of the sub window.

STEP 8 The Internet Protocol (TCP/IP) Properties window will appear.

STEP 9 In this window, two choices appear, they are:

a. Obtain an IP address automatically. This choice sets the computer in the DHCP client mode.

1. If this choice is selected, the ethernet network to which the computer is connected will automatically give it an IP address for that network, as long as that network has a DHCP server.

b. Use the following IP address. This choice sets the computer in the Static address mode.

1. If this choice is selected, enter the desired IP address in the space provided. The first three sections of the address must be the same as the network or VAX-C to which the computer is connected
2. The last section of the address must be a number which is not already in use by that network. It can range from 1 to 254.
3. The subnet mask address will automatically be entered when its space is entered.

5.12.6.1 Verifying The Computer IP Address

When the previous procedure has been completed, the computer's IP address can be verified using the following procedure.

STEP 1 On the computer press Start > Run.

STEP 2 The Run window should open.

STEP 3 The run window open box should display cmd.

a. If cmd is not displayed, type 'cmd'.

b. Next press OK.

STEP 4 The cmd.exe window will open.

STEP 5 Type in 'ipconfig /all', then hit enter.

WARNING: Disconnect primary power prior to servicing.

a. The present computer IP address and other information will appear.

5.12.6.2 VAX-C Screen Captures

VAX-C GUI screens can easily be captured using the Alt - Print Screen keys. The procedure is as follows.

STEP 1 Connect a computer to the VAX-C.

STEP 2 Select the screen to be captured.

STEP 3 Press and hold the Alt key while pressing the print screen key.

a. Earlier Windows programs copied the captured screen to the clipboard.

b. The Windows XP program opens a window which offers many choices including copying the captured screen to the clipboard or saving it as a file to a specified directory.

STEP 4 It may be necessary to change the computer screen resolution if a portion of the VAX-C GUI screen is cut off when it is captured.

STEP 5 If desired, the captured screen may be edited, using a user supplied program, to remove the undesired information which surrounds the captured screen.

Another option for screen captures is a Firefox add-on called screen capture elite. It allows selection and capture of an active window and minimizes the amount of cropping needed.

5.13 Updating VAX-C Software

The latest revision of VAX-C software is available at the Harris Broadcast Customer Portal web site.

NOTE:
The transmitter will go off-air during software updates.

NOTE:
If changing modulation type, enter a new 'feature key' before programming.

NOTE:
Should this procedure result in a crashed or incomplete software download/ update, refer to 5.14 on page 5-48, 'Bootloader Recovery Procedure'.

When the software file is located and saved on your computer, use the following instructions to load the software into the VAX-C.

STEP 1 Connect to the front ethernet connector of the VAX-C. The front connector IP address is static 192.168.117.88.

NOTE:
Instructions for connecting directly to the VAX-C front Ethernet connector is given in Section 5.12.4, Connection Via Front Ethernet Connector, on page -34.

STEP 2 When connected the VAX-C login screen, shown in Figure 5-14, will appear. The default username is 'admin' and the password is: admin. Logging in to the VAX-C must be done prior to loading software.

Figure 5-14 VAX-C Login Screen

STEP 3 Press the Exciter Home soft key on the Xmtr Home page.

STEP 4 Press the Setup soft key on the Exciter Home page.

STEP 5 Press the ISP soft key on the right side of the Setup page.The In System Programming screen, shown in Figure 5-15, will be displayed.

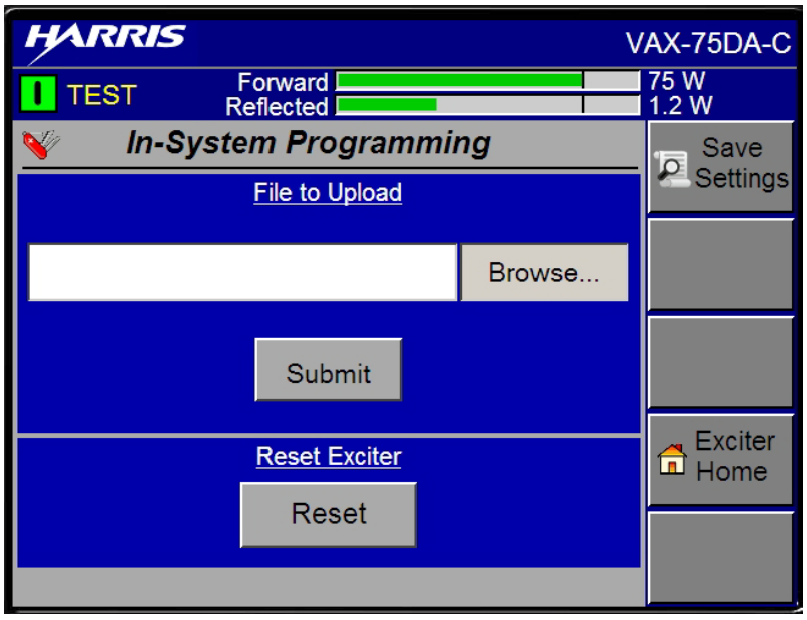


Figure 5-15 VAX-C In-System Programming Screen

WARNING: Disconnect primary power prior to servicing.

STEP 6 Press the Browse soft button to the right of the file to upload box on the In-System Programming screen. This will bring up the File Upload sub window, shown in Figure 5-16.

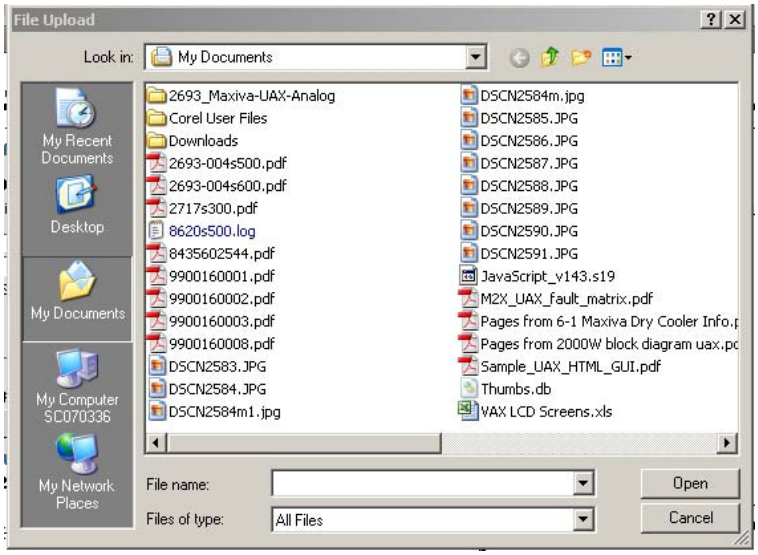


Figure 5-16 File Upload Window

STEP 7 From the File Upload sub window, locate the software file to be downloaded (.s19 file extension). This is the file which was previously down loaded and saved to the computer. When the correct file has been highlighted, press Open.

STEP 8 Press Submit when the In-System Programming screen reappears with the selected file showing in the File to Upload window.

STEP 9 There will be a delay of a minute or two and the screen, shown in Figure 5-17, will appear. When it appears, select Program.

NOTE:
Selecting Upload New would bring up the File Upload screen to select a different file.

WARNING: Disconnect primary power prior to servicing.

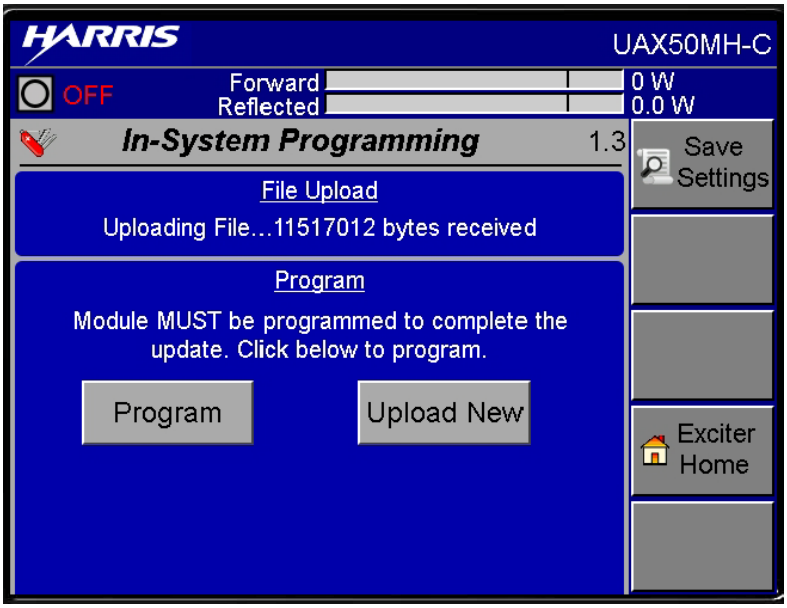


Figure 5-17 In-System Programming Window

STEP 10 The screen shown in Figure 5-18 will appear. Select OK to continue with programming.

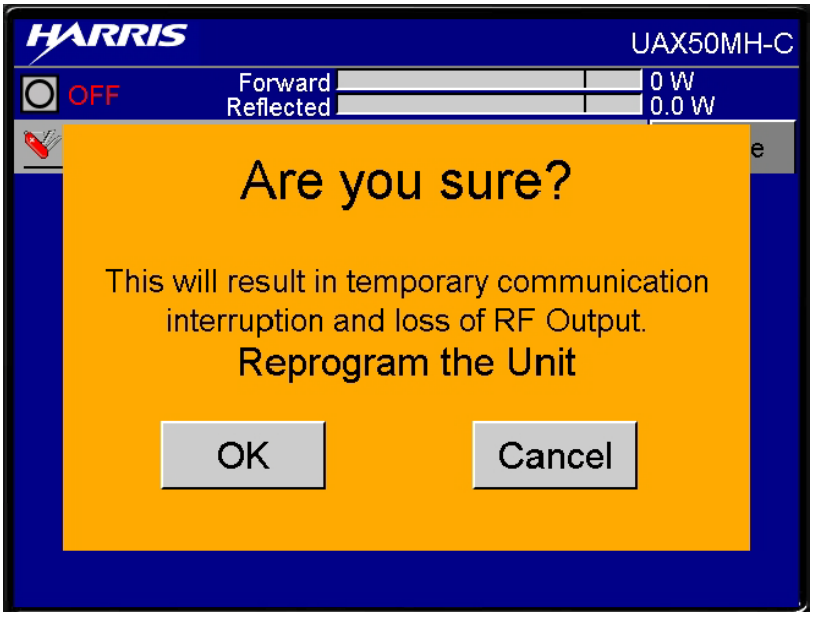


Figure 5-18 Are You Sure Window

WARNING: Disconnect primary power prior to servicing.

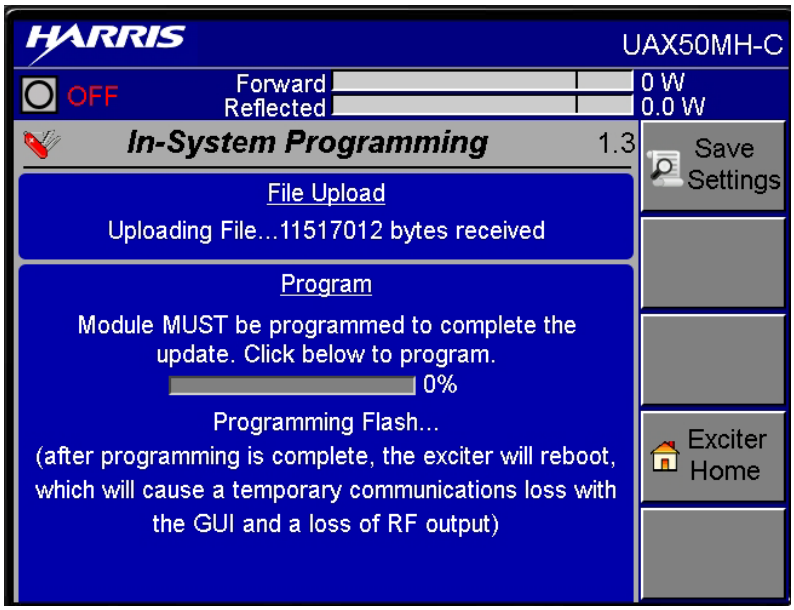


Figure 5-19 Programming Screen

STEP 11 The screen shown in Figure 5-19 will appear indicating that programming has begun. This process will take several minutes. Once programming is complete the web connection to the VAX-C will be broken and communication with the VAX-C will cease (a yellow error screen will be displayed).

STEP 12 When communications is reestablished a login screen will open.

NOTE:
In some instances it may be necessary to exit and then restart the Web browser to establish a new connection.

STEP 13 Log into the VAX-C (name and password required). Use the web browser to navigate to Tx Home>Exciter Home>Status >Revisions screen. The new Build version will be displayed there. If Customer Special appears as the Build Version it indicates a possible problem and the software should be reloaded. The current modulator type can be identified by navigating to the Tx Home>Exciter Home>Setup>Signal Processor box.

STEP 14 End of procedure.

5.13.1 Saving and Recalling Settings

The Save Settings soft key can be used to save a copy of the current user settings stored in EEPROM in the VAX-C. All settings with the exception of the front and rear MAC addresses and feature key, are included. These stored settings can be used to restore a system to known user settings.

NOTE:
The EEPROM data does include calibration data, so if using to duplicate user settings on a second system, the calibration data will be copied over as well. As Calibration data is system specific this will corrupt the calibration; power readings will be inaccurate until they are recalibrated.

To save the current EEPROM settings, select the Save Settings soft key. A new browser tab will open showing the EEPROM file in text format. To save the file, from the Save settings data page, select File> Save Page As

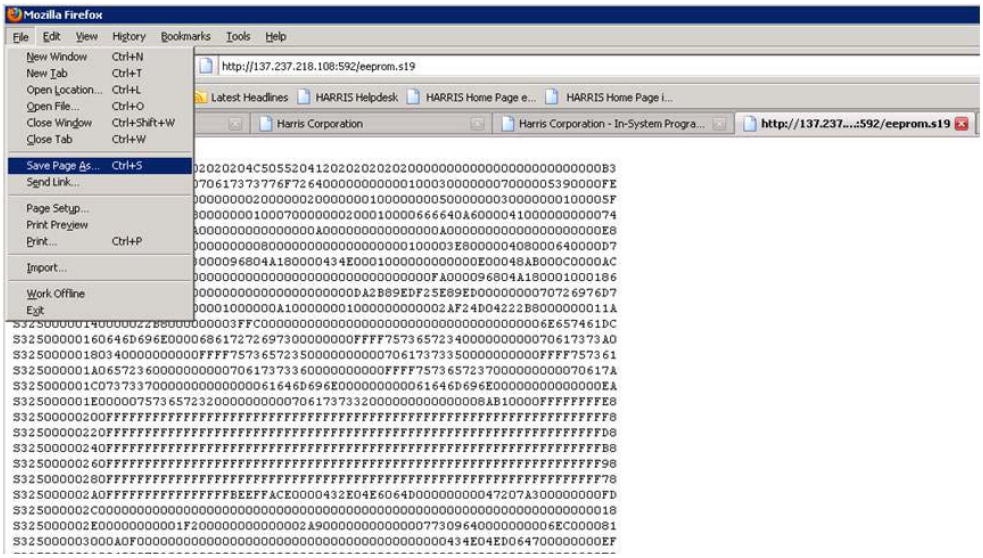


Figure 5-20

Choose where to save EEPROM file, and name the file as desired. Make sure the file extension is '.s19'

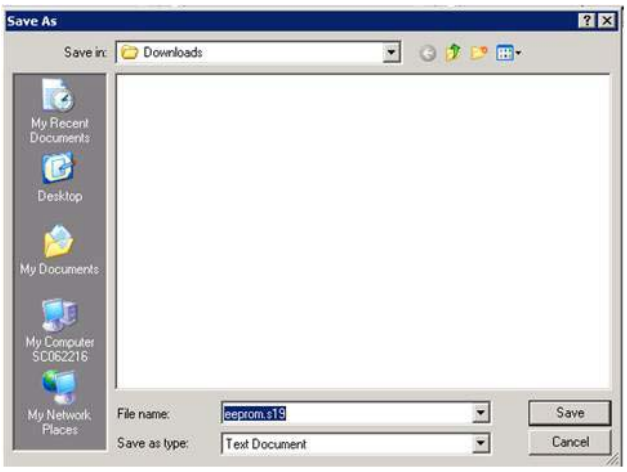


Figure 5-21

In order to restore the settings that are saved in the file, follow the process described in "5.13 Updating VAX-C Software" on page 5-41. Use the .s19 file saved in the previous step as the file to upload.

5.13.2 Web Browser Screen Captures

Web browser GUI screens can easily be captured using the Alt - Print Screen keys. The procedure is as follows.

STEP 1 Connect a computer to the VAX-C.

STEP 2 Select the screen to be captured.

STEP 3 Press and hold the Alt key while pressing the print screen key.

a. Earlier Windows programs copied the captured screen to the clipboard.

b. The Windows XP program opens a window which offers many choices including copying the captured screen to the clipboard or saving it as a file to a specified directory.

STEP 4 It may be necessary to change the computer screen resolution if a portion of the GUI screen is cut off when it is captured.

STEP 5 If desired, the captured screen may be edited, using a user supplied program, to remove the undesired information which surrounds the captured screen.

WARNING: Disconnect primary power prior to servicing.

5.14 Bootloader Recovery Procedure

Recovery from a crashed or incomplete ISP (In-System Programming) download (software update) by invoking the bootloader.

In most cases this can be accomplished using the following procedure:

STEP 1 Connect to the front Ethernet port using instructions in Section 5.12.4.

STEP 2 Open a web browser session via the VAX-C front Ethernet port by entering 192.168.117.88/isp in the navigation box.

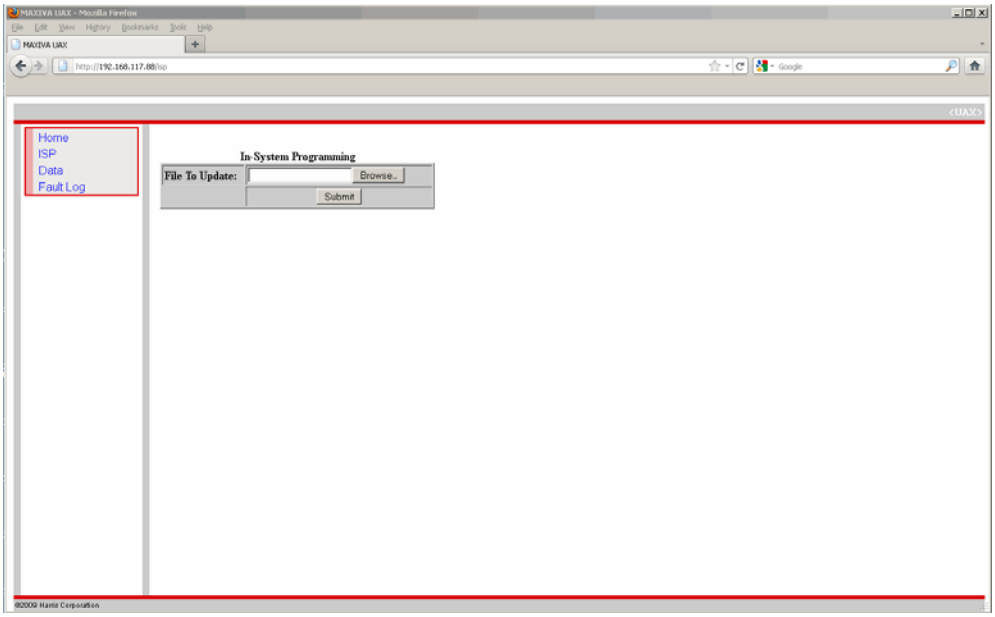


Figure 5-22 Bootloader ISP Screen

STEP 3 Use the Browse button to locate the software file on your PC. The filename will be similar to APEXM2X_ATSC_REVAK.s19. The modulation type and the revision level will vary.

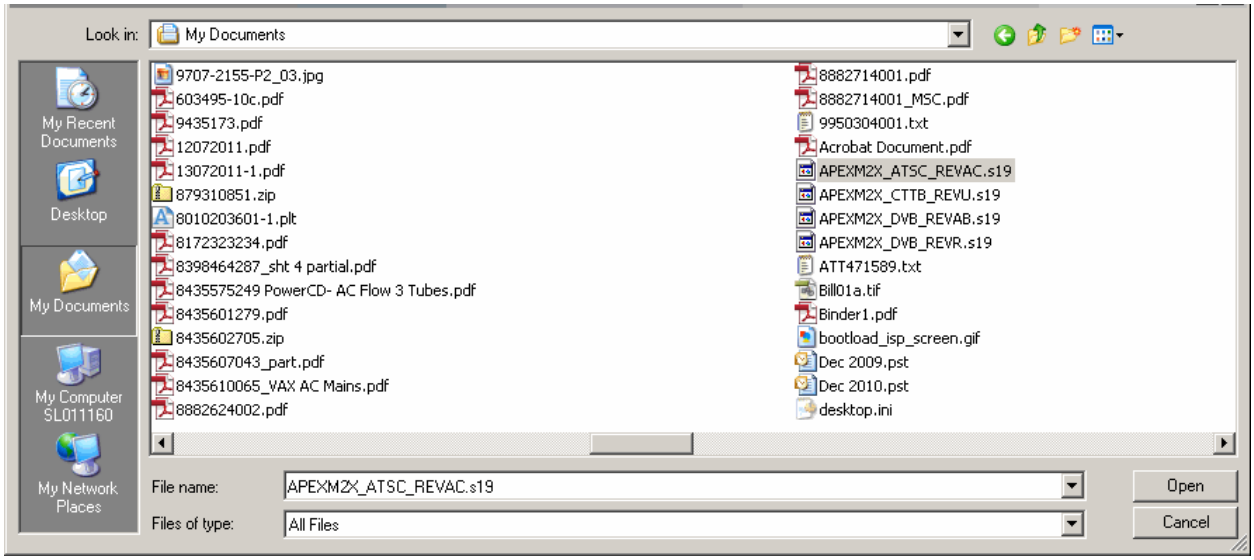


Figure 5-23 Bootloader Browse Screen

STEP 4 Highlight the desired file then press Open.

STEP 5 The bootloader ISP screen will be displayed and the 'File to Update:' window will display the filename. Press 'Submit'. The update will take several minutes. Do not disrupt the process.

STEP 6 Upon completion of the process open a web browser session to reestablish the connection to the VAX-C transmitter.

STEP 7 End of procedure.

In instances where the IP address is unknown or when the above procedure fails the following procedure may be used:

STEP 1 Connect a serial cable from PC / laptop to the VAX-C.

STEP 2 Start a terminal program (115,200,N,8,1) and make sure it is the active PC window/program.

STEP 3 Hold down the escape (ESC) key and power cycle the transmitter by either plugging and unplugging the unit or by using the reset button behind the front panel. Hold the escape key until you see the message 'Starting Ethernet Downloader' at the bottom of the screen. It should appear right away.

WARNING: Disconnect primary power prior to servicing.

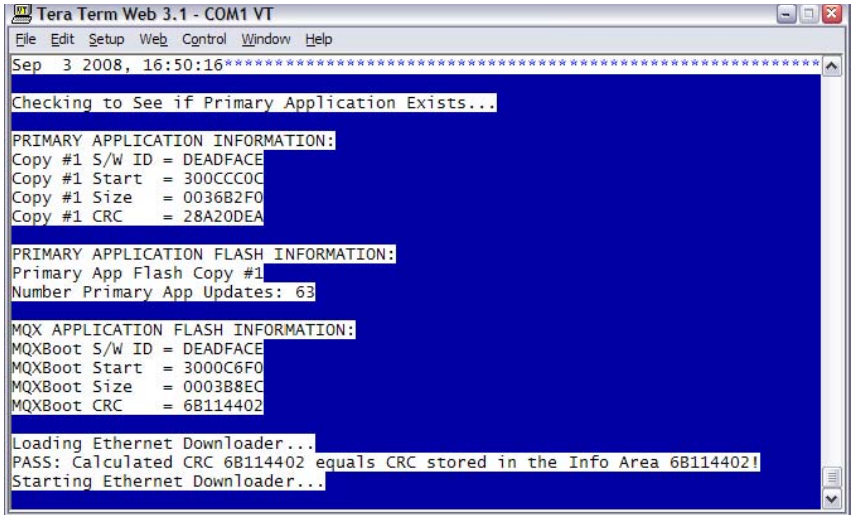

Tera Term Web 3.1 - COM1 VT
File Edit Setup Web Control Window Help
Sep 3 2008, 16:50:16
Checking to See if Primary Application Exists...
PRIMARY APPLICATION INFORMATION:
Copy #1 S/W ID = DEADFACE
Copy #1 Start = 300CCC0C
Copy #1 Size = 0036B2F0
Copy #1 CRC = 28A20DEA
PRIMARY APPLICATION FLASH INFORMATION:
Primary App Flash Copy #1
Number Primary App Updates: 63
MQX APPLICATION FLASH INFORMATION:
MQXBoot S/W ID = DEADFACE
MQXBoot Start = 3000C6F0
MQXBoot Size = 0003B8EC
MQXBoot CRC = 6B114402
Loading Ethernet Downloader...
PASS: Calculated CRC 6B114402 equals CRC stored in the Info Area 6B114402!
Starting Ethernet Downloader...

Figure 5-24 Ethernet Downloader Screen

STEP 4 Double strike the enter key to bring up the basic Ethernet screen.

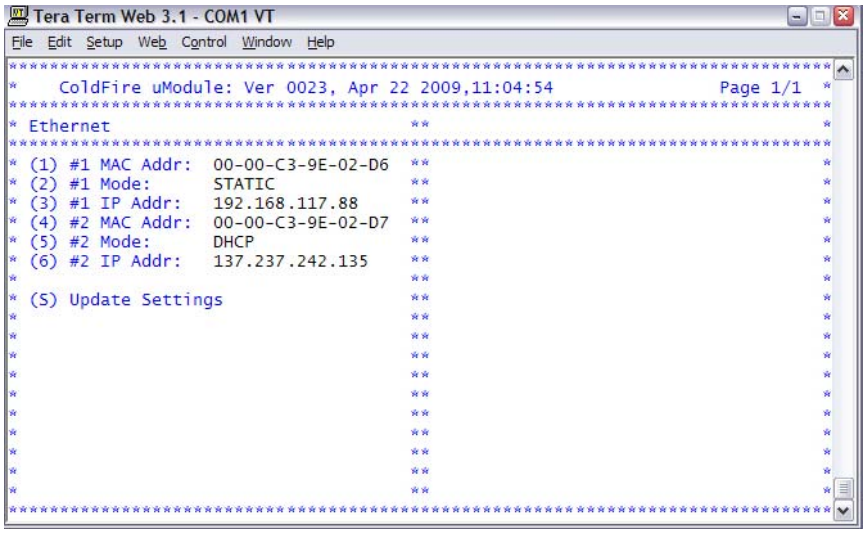
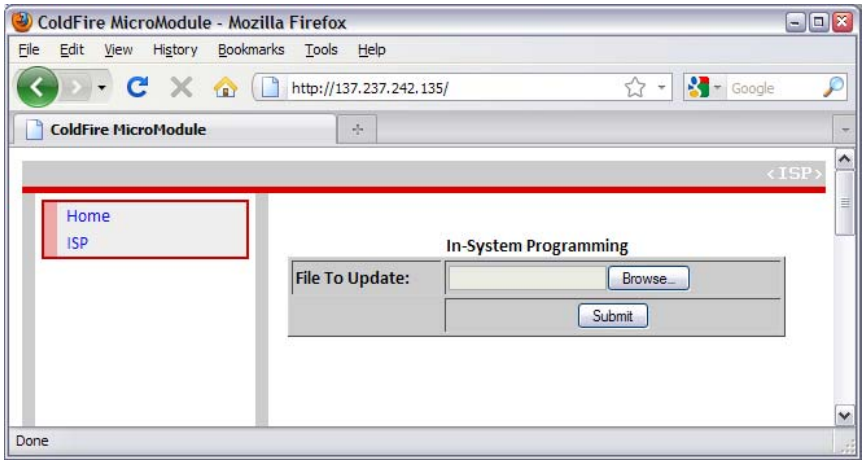

Tera Term Web 3.1 - COM1 VT
File Edit Setup Web Control Window Help
ColdFire uModule: Ver 0023, Apr 22 2009,11:04:54 Page 1/1
Ethernet
(1) #1 MAC Addr: 00-00-C3-9E-02-D6
(2) #1 Mode: STATIC
(3) #1 IP Addr: 192.168.117.88
(4) #2 MAC Addr: 00-00-C3-9E-02-D7
(5) #2 Mode: DHCP
(6) #2 IP Addr: 137.237.242.135
(S) Update Settings

Figure 5-25 Tera Term Ethernet Screen

STEP 5 Use the static IP from the front panel or network settings of the rear IP port that may have been previously configured. Open a web browser and type in the appropriate IP address. The In-System Programming (ISP) screen will appear.



STEP 6 Proceed to load the complete *.s19 file.

STEP 7 End of procedure.

WARNING: Disconnect primary power prior to servicing.

5.15 Connecting to the VAX via SNMP

The VAX-C transmitter family supports monitoring and alarming functionality via SNMP (Simple Network Management Protocol). Basic control of the equipment is possible after activation in the equipment. SNMP versions V1 and V2c and V3 are implemented.

This section assumes a good working knowledge of networking and SNMP connectivity. The information contained here is not meant to teach networking or how to setup/operate a network manager application, but merely provide the information necessary for a network administrator to connect and operate the VAX-C transmitter using the SNMP connection.

5.15.1 SNMP Configuration

Setup for SNMP operation is done via the web browser by navigating to the VAX-C SNMP setup screen. Press Exciter Home > Setup > Remote Communications > NEXT > NEXT.

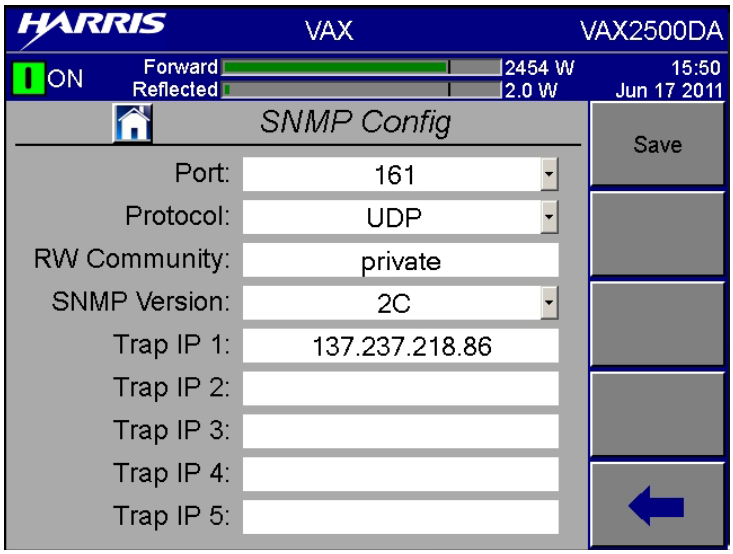


Figure 5-26 LPU SNMP Setup Screen

The SNMP setup screen allows location setting for connection identification, destination IP address for trap messages, R/W community, Enable/Disable of Set commands, Port, selection of V1 or V2 traps and deletion of IP addresses.

5.15.2 Supported MIBs

As of this printing, the Harris VAX transmitter can serve out three different MIBs:

- Harris transmitter base MIB (basic functionality for all Harris transmitters)
- IRT DVB Single Transmitter MIB
- IRT DAB Single Transmitter MIB

5.15.3 Harris Base MIB Description

The Harris base MIB is usable in all NMS (Network Management Systems) and is provided in text-format. The base MIB has the advantage of being common to many different Harris equipment types, thus allowing many different Harris devices to be monitored once the MIB is imported to the NMS.

Once an alarm has been signaled in SNMP, an Internet browser can be opened in the NMS for full monitoring and control capabilities via the HTTP web remote.

5.15.4 Shortcuts

Following shortcuts are used in the MIB descriptions:

- • OS:Octet String
- • TT: Time Tick
- • OID: Object Identifier
- • G32: Gauge 32
- • TRV: TRuth Value
- • ENU: ENUmerations
- • RO: Read Only
- • RW: Read Write

5.15.5 Harris SMI (Structure of Managed Information)

Harris Transmission SMI
Harris Transmitters branch OID: 1.3.6.1.4.1.290.9.2.1
iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).harris(290).bcd2(9).transmission(2)

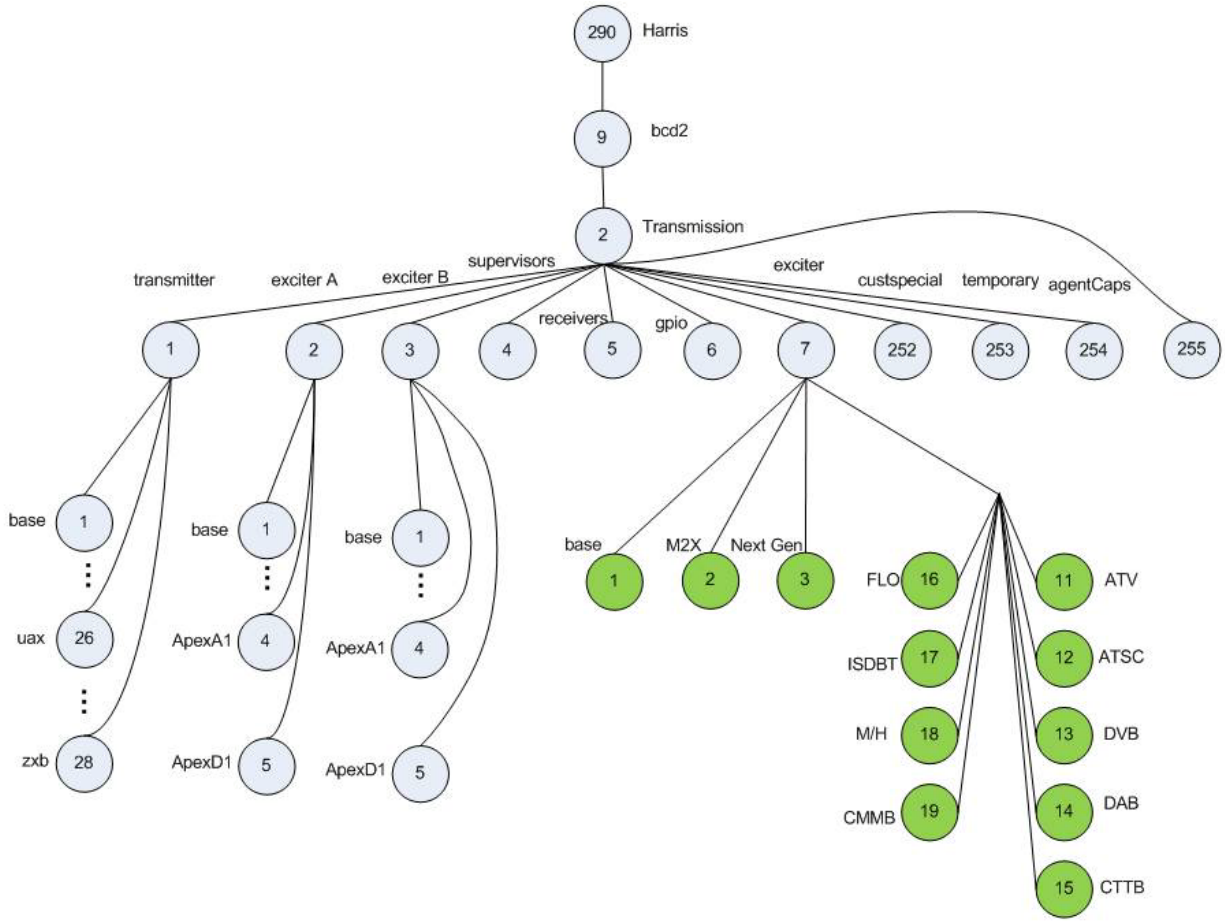


Figure 5-27 Harris SMI Block Diagram

WARNING: Disconnect primary power prior to servicing.

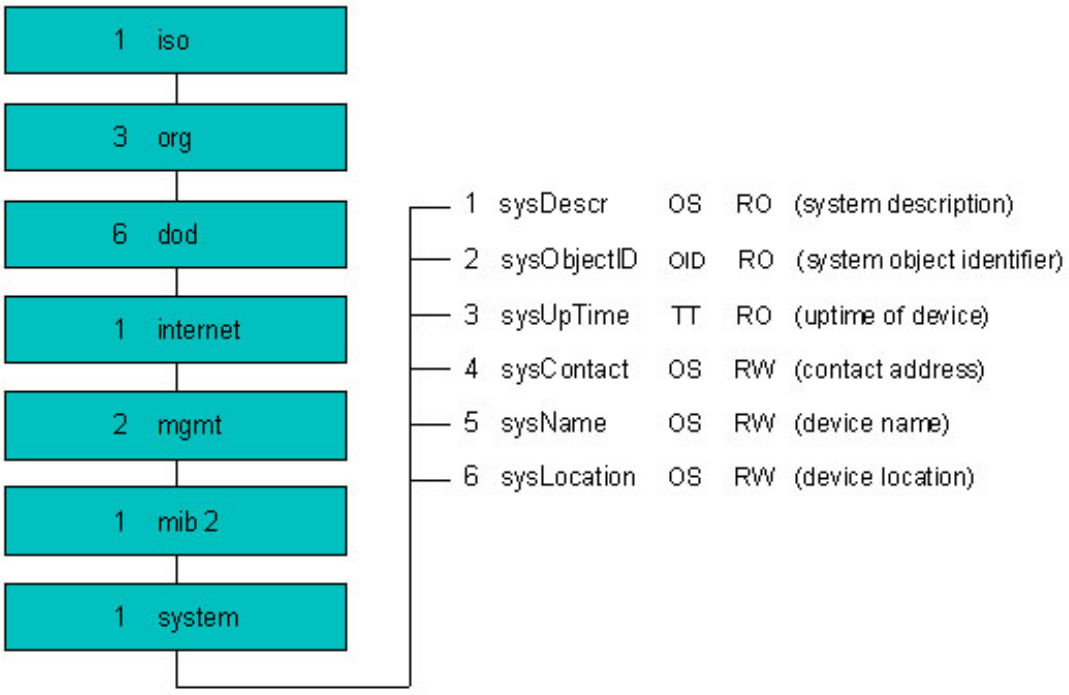

1 iso
3 org
6 dod
1 internet
2 mgmt
1 mib 2
1 system
1 sysDescr OS RO (system description)
2 sysObjectID OID RO (system object identifier)
3 sysUpTime TT RO (uptime of device)
4 sysContact OS RW (contact address)
5 sysName OS RW (device name)
6 sysLocation OS RW (device location)

Figure 5-28 MIB 2 Description

WARNING: Disconnect primary power prior to servicing.

5.16 DAB Single Frequency Network (SFN) Setup

A popular option for DAB/ T-DMB implementation is the single frequency network (SFN). In a single frequency network, all transmitters in a geographic region are synchronized in frequency and modulation content (symbol). For such a system to work, two parameters must be tightly controlled at the transmitter site: the RF center-channel frequency and the program modulation (symbol) delay.

For SFN operation, the RF center-channel frequency in the VAX-C is locked to an internal 10 MHz reference oscillator. The 10 MHz oscillator is, in turn, locked to a 1 pps reference signal from an internal or external GPS receiver. This holds the frequency to within the 10Hz recommended precision level for SFN operation in DAB mode 1, Band III.

The symbol delay is controlled by three different parameters in the LPU: *dynamic delay*, *static delay*, and *offset delay.*

5.16.1 Dynamic Delay

Dynamic Delay is an automatic system addressing delays in the ETI distribution network from the multiplexer to the transmitter input. The exciter compares timing information embedded in the incoming ETI stream against a locally received GPS - 1 pps reference. Each individual transmitter site adds additional delay to synchronize its ETI input signal to a target “maximum network delay” value added to the ETI stream at the multiplexer. The maximum network delay set to be equal to the ETI transit delay to the furthest site, plus a safety margin.

This forces all sites to be in synchrony at the dynamic delay control point at the input to the COFDM encoder. Site-to-site differences in signal processing delays occurring after the dynamic delay circuit inside the COFDM encoder (i.e. outside dynamic delay control zone) are addressed by the static delay setting.

Dynamic delay is sometimes known as “Network Padding Delay"

5.16.2 Static Delay

Static Delay is a fixed setting to compensate for different processing delays in DAB transmitters from different manufacturers arising after the dynamic delay circuit (i.e. outside dynamic delay control zone). The static delay for each site may be set via the web remote interface. Each individual transmitter site adds additional static delay to make its output synchronized with the output of the most-delayed site in the network.

Static delay is sometimes known as “Transmitter Trimming Delay”

5.16.3 Offset Delay

Offset Delay is a fine tune setting to delay the output of an individual transmitter to alleviate real-world reception difficulties typically due to localized geographical conditions or unequal transmitter powers. The offset delay at each site can be controlled remotely from the multiplexer via the ETI stream.

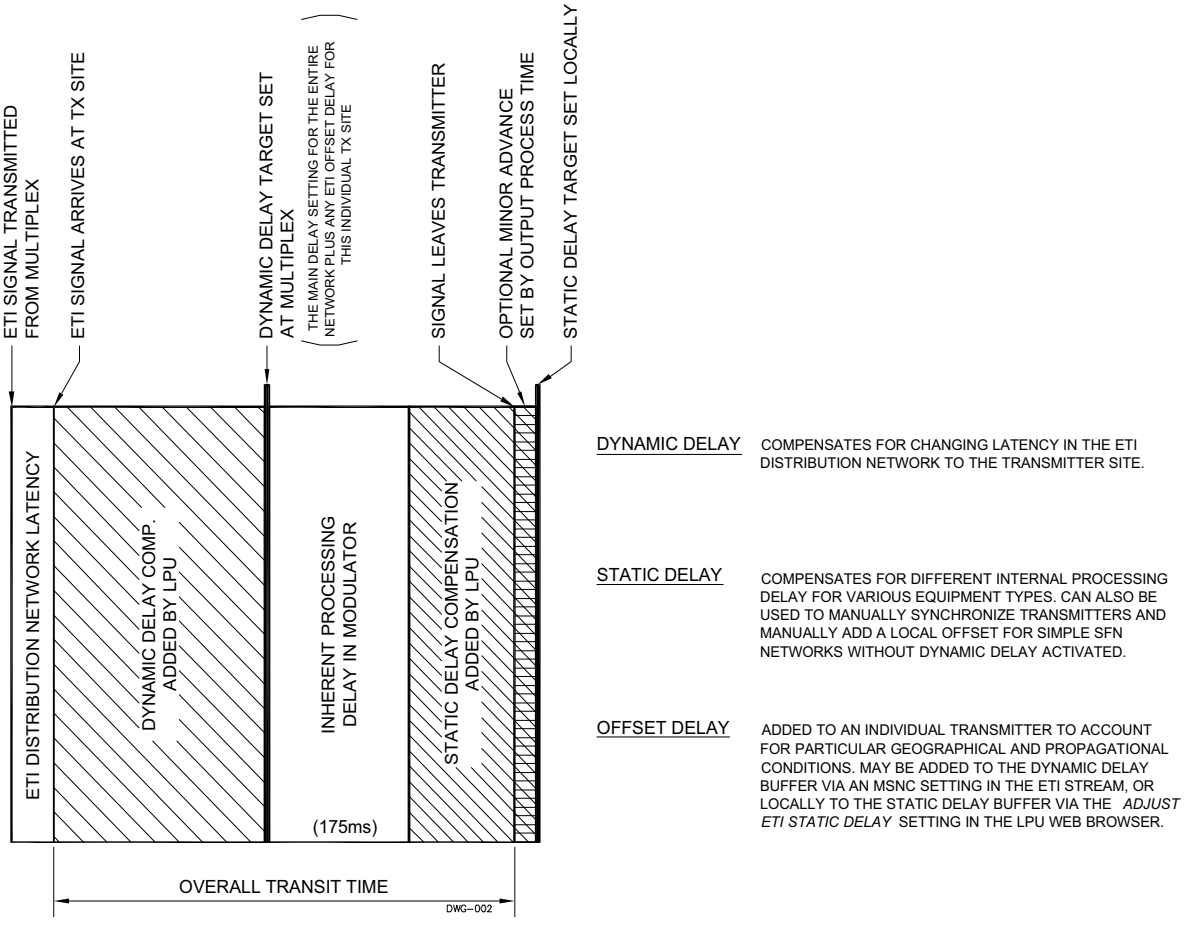

ETI SIGNAL TRANSMITTED FROM MULTIPLEX
ETI SIGNAL ARRIVES AT TX SITE
DYNAMIC DELAY TARGET SET AT MULTIPLEX
THE MAIN DELAY SETTING FOR THE ENTIRE NETWORK PLUS ANY ETI OFFSET DELAY FOR THIS INDIVIDUAL TX SITE
SIGNAL LEAVES TRANSMITTER
OPTIONAL MINOR ADVANCE SET BY OUTPUT PROCESS TIME
STATIC DELAY TARGET SET LOCALLY
ETI DISTRIBUTION NETWORK LATENCY
DYNAMIC DELAY COMP. ADDED BY LPU
INHERENT PROCESSING DELAY IN MODULATOR
STATIC DELAY COMPENSATION ADDED BY LPU
(175ms)
OVERALL TRANSIT TIME
DWG–002
DYNAMIC DELAY
COMPENSATES FOR CHANGING LATENCY IN THE ETI DISTRIBUTION NETWORK TO THE TRANSMITTER SITE.
STATIC DELAY
COMPENSATES FOR DIFFERENT INTERNAL PROCESSING DELAY FOR VARIOUS EQUIPMENT TYPES. CAN ALSO BE USED TO MANUALLY SYNCHRONIZE TRANSMITTERS AND MANUALLY ADD A LOCAL OFFSET FOR SIMPLE SFN NETWORKS WITHOUT DYNAMIC DELAY ACTIVATED.
OFFSET DELAY
ADDED TO AN INDIVIDUAL TRANSMITTER TO ACCOUNT FOR PARTICULAR GEOGRAPHICAL AND PROPAGATIONAL CONDITIONS. MAY BE ADDED TO THE DYNAMIC DELAY BUFFER VIA AN MSNC SETTING IN THE ETI STREAM, OR LOCALLY TO THE STATIC DELAY BUFFER VIA THE ADJUST ETI STATIC DELAY SETTING IN THE LPU WEB BROWSER.

Figure 5-29 Graphical Representation of DAB Signal Delays

WARNING: Disconnect primary power prior to servicing.

5.17 DAB EDI/IP Input Option

NOTE:
The DAB EDI/IP board (9810274009G) consists of the MCF5484 UC Module (9010213011G) added to the DAB ETI Input Option (9810274012G). The original ETI input board (9010215291G) is part of the 9810274012G.

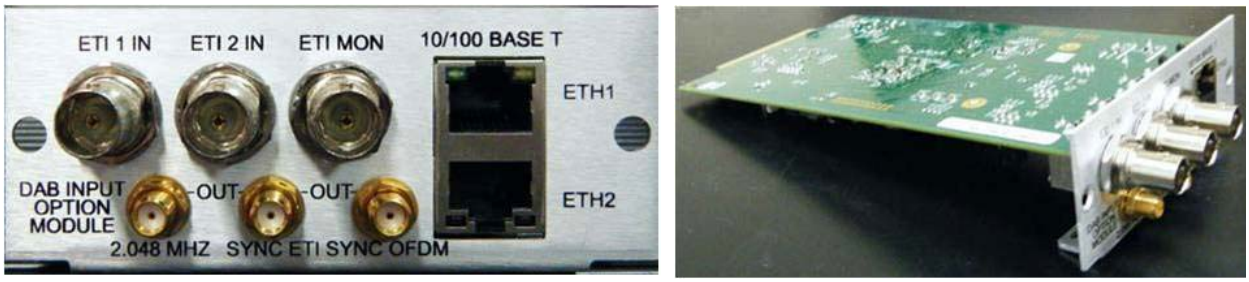


Figure 5-30 Assembly DAB EDI/IP Inuput Option

5.17.1 Overview

EDI (Encapsulation of DAB Interfaces) allows the broadcaster to encapsulate the ETI streams into an Internet Protocol stream for distribution to the DAB Modulator. The EDI board has two 10/100 BaseT Ethernet ports in addition to the two ETI inputs. The EDI IP stream is received by the EDI processor and is then converted to an ETI stream for input by the DAB Modulator.

5.17.2 Installation and Setup

The card is inserted into a rear slot of an M2X exciter, VAX LPU, or VAX-C unit. Setup is via M2X, LPU or VAX-C graphical user interface (GUI). Software updates are performed via ISP over the ETH1 port (IP address on this port is fixed 192.168.117.88).

Figure 5-31 DAB EDI/IP Input Option Installed in VAX-C

WARNING: Disconnect primary power prior to servicing.

5.17.3 Inputs/Outputs

- Two ETI, BNC, 75 ohm, female inputs - labeled ETI1 IN and ETI2 IN
- One ETI, BNC, 75 ohm, female output - labeled ETI MON
- Two 10/100 BaseT network, RJ45 ports on the rear panel - labeled ETH1 and ETH2
- Three SMA, 50 ohm, female outputs - labeled 2.048 MHz-Out, SYNC ETI Out, & SYNC OFDM Out

5.17.4 Operation

One EDI stream can be processed by the EDI board along with one ETI stream. If EDI is not used then two ETI input streams can be used. The multiplexer sends EDI data to the IP address of the EDI board. The processor on the EDI board receives the EDI data, converts it to an ETI stream, and outputs the ETI stream to the DAB modulator.

5.17.5 M2X, LPU or VAX Interface

Interface
- EDI per ETSI TS 102 693 V1.1.2
- 1x Channel
- 10/100 BaseT (RJ45)

Protocols
- UDP/DCP
- TCP/DCP

Processing
- 1x Stream (ETH2)
- Forward Error Correction (RS) Code Strength 1-5 (auto-detecting)
- SFN preservation
- Adjustable buffer depth

Control and Management
- Exciter screens for IP setup
- In-system programmable over ETH1 interface

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5.17.6 GUI Screens

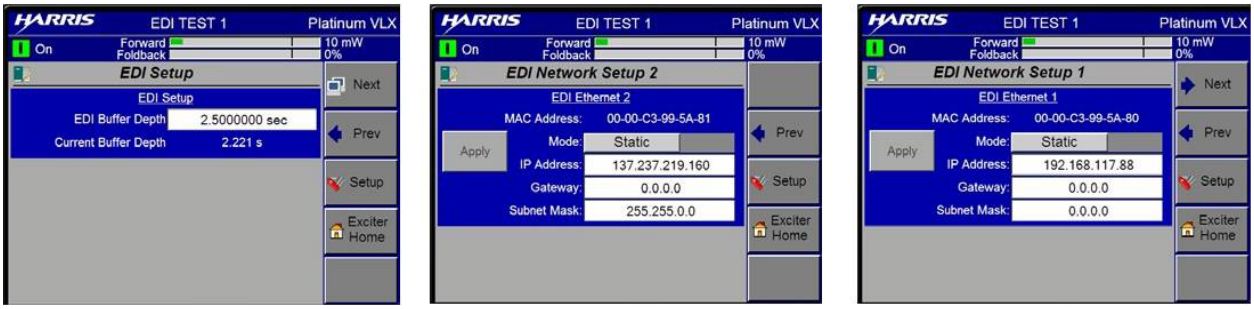


Figure 5-32 EDI Setup Screens

Setup screens can be accessed by using the M2X, LPU or VAX-C GUI interface and navigating to Exciter Home>Setup>DAB Modulator>EDI.

Figure 5-33 DAB Setup Screen and EDIStatus Screen

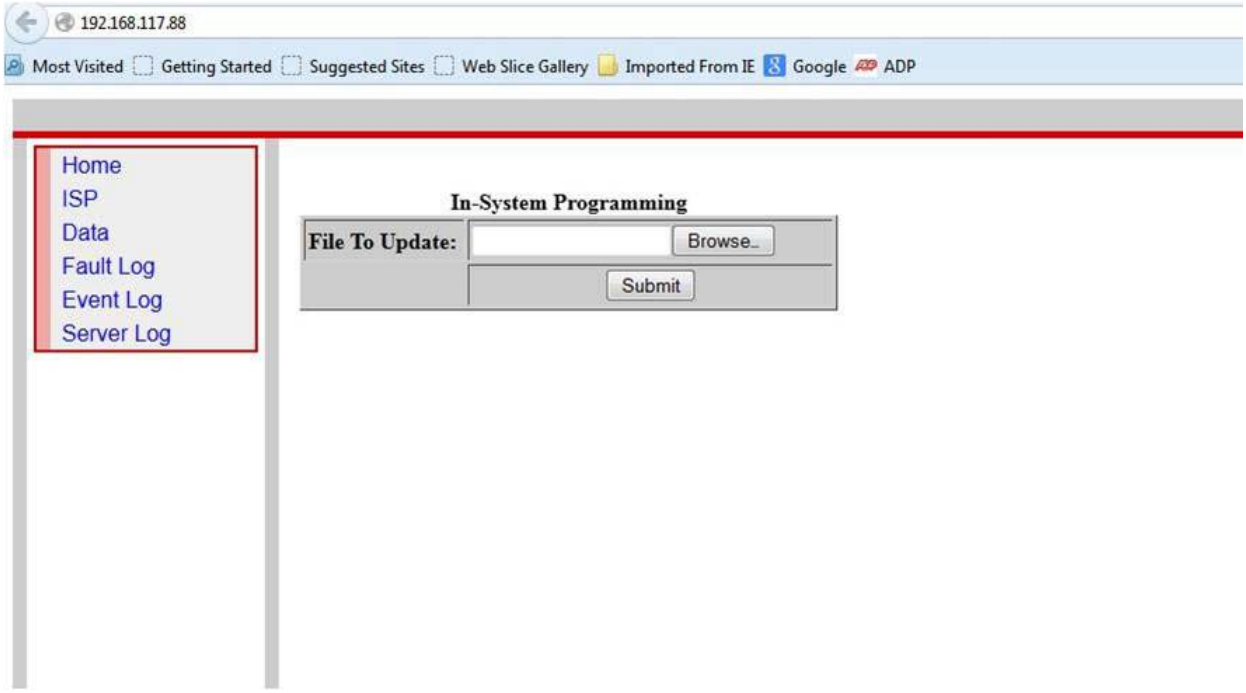
5.17.7 References

Technical Specification, ETSI TS 102 xxx V1.1.1 (2008-10-21) Digital Audio Broadcasting (DAB); Encapsulation of DAB Interfaces (EDI)

5.17.8 EDI Software Update

Connect an Ethernet cable between a computer and EDI board ETH 1. The ETH 1 port is a DHCP server and should automatically assign your computer an IP Address. Check your computers IP address to verify that it is given a 192.168.117.# IP address. On the computer open a Firefox session, in the address bar, type in 192.168.117.88, you should see the below GUI screen. Select browse and navigate to location of software file

"EDI_BETA_VERSION_0x0036.s19". Hit Submit, after a minute you should see the "Program" button, select it. The EDI board will reboot after programming.



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5.18 Typical Test Equipment

Table 5-2 Recommended Test Equipment

Equipment Type	Manufacturer	Model Number	Options	Harris Part No. (if applicable)
TV Spectrum Analyzer	R&S	ETL	ETL-B203 RF pre-select.	
			FSL-B4 OCXO Ref. Freq.	
			FSL-B7 Nar. Res. Filters	
			ETL-K220 ATSC Demod.	
			DIV7 ETL-K208 Meas. Log	
Demodulator	R&S	EFA		instead of ETL
Spectrum Analyzer	Agilent	4402		instead of ETL
Power measurement	Agilent	E44182B power meter with E9300B sensor, 100 uW to 3 W		
Frequency measurement	Agilent	53131A or 53181A	010 high stability time base 015 range extension to 1.5 GHz, OR 030 range extension to 3.0 GHz	
Miscellaneous Test Equipment	Bird	APM-16 wattmeter, with 1W to 1kW elements		
	Narda	Directional coupler		620-0457-000
	Eagle	RLB-150 RF bridge		700-1289-000
	Eagle	TNF-200 VHF RF notch filter		484-0300-000
	Fluke	87 digital multimeter with 801-400 current probe		
Optional Adapters and connectors	Myat	3-1/8 inch to 4-1/16 inch adaptor		620-2395-000
	Dielectric	3-1/8 inch to 4-1/16 inch adaptor		620-1928-000
	Myat	3-1/8 inch to 6-1/8 inch adaptor		620-2297-000
		3-1/8 inch to type N adaptor		620-2859-000
Adapters and connectors		Type N to BNC, male to female		620-0128-000
		Type N to BNC, female to male		620-0547-000
		BNC barrel, female to female		620-0604-000
		BNC barrel, male to male		620-0564-000
		SMA to BNC, male to female		620-2611-000
		SMA to N, male to female		620-2562-000
		SMB (push on) to BNC		620-0628-000
		SMC to BNC, screw on jack to plug		620-2563-000
		BNC to TNC, jack to plug		620-2821-000
		BNC to TNC, jack to jack		620-2823-000
		TNC to N, plug to jack		620-2824-000
		TNC to N, jack to plug		620-2822-000
Attenuator		10 dB attenuator, type N, male to female		556-0074-000

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Table 5-3 DAB Test Equipment

Equipment Type	Manufacturer	Model Number	Options	Harris Part No. (if applicable)
Spectrum Analyzer	R&S/Agilent	FSU, FSP/ESA		
Network Analyzer	R&S/Agilent	ZVL-3/HP8753C,(D),(E), (ES)		
Notch Filter	Eagle	TNF-210BFBF VHF RF notch filter		
Oscilloscope	Tektronix	TDS 3032		
Multimeter	Fluke	89 IV digital multimeter with 801-400 current probe		
Power Meter	R&S/Agilent	NRP-Z11/ HP436A, HP437B, E44182B power meter with E9300B sensor, 100 uW to 3 W		
GPS Antenna	Panasonic	CCAH32ST01		
GPS Time Reference	Harris	Exciter		
Frequency measurement	Agilent	53131A or 53181A	010 high stability time base 015 range extension to 1.5 GHz, OR 030 range extension to 3.0 GHz	
Miscellaneous Test Equipment	Bird	APM-16 wattmeter, with 1W to 1kW elements		
Reject Loads	/Bird			
Directional Coupler	Narda			620-0457-000
Bridge	Eagle	RLB-150 RF bridge		700-1289-000
Notch Filter	Eagle	TNF-210BFBF VHF RF notch filter		484-0300-000
Useful Adapters and connectors	Myat	3-1/8 inch to 4-1/16 inch adaptor		620-2395-000
	Dielectric	3-1/8 inch to 4-1/16 inch adaptor		620-1928-000
	Myat	3-1/8 inch to 6-1/8 inch adaptor		620-2297-000
		3-1/8 inch to type N adaptor		620-2859-000

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Table 5-3 DAB Test Equipment

Equipment Type	Manufacturer	Model Number	Options	Harris Part No. (if applicable)
Adapters and connectors		Type N to BNC, male to female		620-0128-000
		Type N to BNC, female to male		620-0547-000
		BNC barrel, female to female		620-0604-000
		BNC barrel, male to male		620-0564-000
		SMA to BNC, male to female		620-2611-000
		SMA to N, male to female		620-2562-000
		SMB (push on) to BNC		620-0628-000
		SMC to BNC, screw on jack to plug		620-2563-000
		BNC to TNC, jack to plug		620-2821-000
		BNC to TNC, jack to jack		620-2823-000
		TNC to N, plug to jack		620-2824-000
		TNC to N, jack to plug		620-2822-000
Attenuator		10 dB attenuator, type N, male to female		556-0074-000

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Section 6 Diagnostics

6

6.1 Introduction

This section contains diagnostic and troubleshooting information for the VAX-C series VHF transmitter. Included is a complete description of all faults which can be displayed via the transmitter front panel LCD, Web Interface or TCU (transmitter control unit GUI (Graphical User Interface). Due to the complexity of the transmitter control system and the extensive use of surface mount components, the scope of this diagnostics section is to isolate the problems down to a PC board or module level which can then be easily exchanged.

The buttons and icons used in the web browser use a color code system. Some examples are given below.

a. Green with a 1 - - ON and operating normally.

b. Green symbol - - ON and operating normally.

c. Light Gray - - "Grayed Out" - Not communicating or not available.

d. Yellow -

Warning - A non-critical sub-system or parameter is out of tolerance and should be addressed by engineering personnel.

e. Red -

- Critical Fault - This could be a sub-system fault in which the sub-system is muted or shut off (such as a PA module) or could be a system level fault which could mute or shut the transmitter off.

When a fault occurs, one or more of the LED's on the transmitter control panel will illuminate red. To track down the cause of the fault, open the transmitter fault log via

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web browser and see what faults have occurred and in what order. If you are not familiar with web browser navigation, refer to Section 3.1 Transmitter Control and to 6.2 Web Browser Fault Log below.

The fault log on the LCD (in Status menu) will also give detailed fault information but is smaller and will take longer to read, as it only shows 4 faults per page. If the fault information is more than 11 characters, the description will be truncated. If this occurs refer to the web browser for complete fault description. Fault log information is stored on EEPROM, thus it will be retained if power is cycled.

6.2 Web Browser Fault Log

The web browser allows access to listings of any faults or warnings that have occurred. The VAX-C fault log is accessed by pressing the Fault Log soft button on the right side of the VAX-C Exciter Home screen. This will bring up the VAX-C Fault Log - All Faults screen. The fault logs give the following information:

a. **Order -** The VAX-C fault log stores up to 500 entries, after which, faults are deleted on a FIFO basis. The last fifty faults can be viewed in the VAX-C fault log. The entire fault log including older faults can be viewed or exported via the web browser by navigating to the VAX-C Status screen and pressing Export Flt-Log.

b. **Set** - Time (24 hour format) and date (month, day, year) that the fault occurred.

c. **Clear** - Time and date that the fault was cleared. If the fault is still active, the Clear field will be blank.

d. **Name** - Name and description of the fault.

The Fault Log is color coded as follows:

- Grey – Inactive Faults/Warnings
- Yellow – Active Warnings
- Red – Active Faults

Function Buttons:

a. **Reset Log (VAX-C) -** Erases all inactive faults in the log.

b. **Active Faults (VAX-C) -** Lists only active faults.

NOTE:
Tables 6-1 and 6-2 list VAX-C transmitter faults. They also give a brief description of each fault, the trip point and the transmitter action to take in response to the fault.

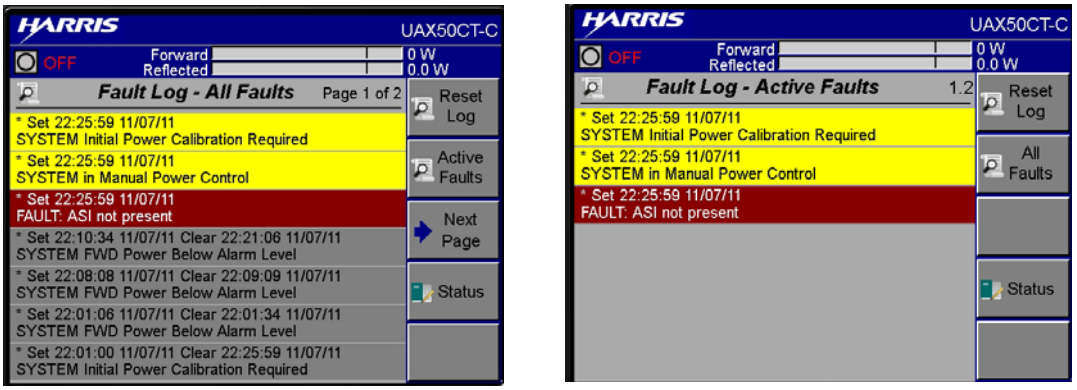

Figure 6-1 ***on left*** **- All Faults Log Screen** ***on right*** **- Active Faults Log Screen**

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6.3 Fault Tables

The following tables provide a listing of VAX-C Transmitter faults along with a brief description, the fault level or threshold and the action taken by the transmitter.

Table 6-1 UDC Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Upconverter IF level	Indicates up/down converter IF level is out of range low	Mute LED red. System and Mute LEDs red.	1000mV +/- 100mV, detector referenced to mixer input level.	900mV *NOTE:* Test tone levels have not been characterized for any special considerations. Indicated levels are for normal modulation.
Upconverter IF level	Indicates up/down converter LO level is out of range high	System and Mute LEDs red.	1000mV +/- 100mV, detector referenced to mixer input level.	> 1100mV *NOTE:* Test Tone levels have not been characterized for any special considerations. Indicated levels are for normal modulation.
Upconvertor LO level	Indicates up/down converter LO level is out of range low	System and Mute LEDs red.	0dBm	LO level < -5.6dBm
Upconvertor LO level high	U converter LO level high warning	System LED orange.	LO Level Input should be 0dBm	LO level > -5.4dBm

Table 6-2 MODFPGA Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Modulator Not Alive	Indicates MOD FPGA is in known good state	System and Mute LEDs red.	Data pattern written/ read over HPI matches	Data pattern written/read over HPI does not match
Modulator Temperature Fault	Indicates MOD FPGA is over temperature	System and Mute LEDs red.	Over temperature less than 4 times. 85 C limit.	Over temperature 4 times (no time limit). 85 C limit
Modulator DAC Clock	Indicates DAC clock is present in MOD FPGA	System and Mute LEDs red.	DAC clock detected	DAC clock is not detected
Modulator Sample Clock	Indicates MOD clock is present in MOD FPGA	System and Mute LEDs red.	Modulator sample clock and 10 MHz internal clock edges are both detected	Either modulator sample clock or 10 MHz internal clock edges are not detected
Modulator 4X Sample Clock	Indicates MOD clock x4 is present in MOD FPGA	System and Mute LEDs red.	Modulator 4 x sample clock edges are detected	Modulator 4 x sample clock edges are not detected

WARNING: Disconnect primary power prior to servicing.

Table 6-2 MODFPGA Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Modulator 25MHz Clock	Indicates 25 MHz clock is present in MOD FPGA	System and Mute LEDs red.	25 MHz clock edges are detected	25 MHz clock edges are not detected
Modulator 54MHz Clock	Indicates 54 MHz clock is present in MOD FPGA	System and Mute LEDs red.	54 MHz clock edges are detected	54 MHz clock edges are not detected
Modulator User Force Mute	Indicates user has forced mute from GUI	System and Mute LEDs red.	Mute not selected on GUI	Mute selected on GUI

Table 6-3 MODFPGA Modulation Specific Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
DVB (modulation specific)				
ASI 1 HP	Indicates error on ASI 1 HP in MOD FPGA for DVB	System LED red.	No errors	Input present: Uncorrected byte errors, Corrected byte errors, Buffer overflow, MIP errors ((CRC error OR MIP missing) AND (SFN or MFN AND MIP control)) Input not present: ERRW_MODFPGA_PRBS_ON =false
ASI 1 LP	Indicates error on ASI 1 LP in MOD FPGA for DVB	System LED red.	No errors	Input present: Uncorrected byte errors, Corrected byte errors, Buffer overflow Input not present: Hierarchy mode AND ERRW_MODFPGA_PRBS_ON =false
ASI 2 HP	Indicates error on ASI 2 HP in MOD FPGA for DVB	System LED red.	No errors	Input present: Uncorrected byte errors, Corrected byte errors, Buffer overflow, MIP errors ((CRC error OR MIP missing) AND (SFN or MFN AND MIP control)) Input not present: ERRW_MODFPGA_PRBS_ON =false

WARNING: Disconnect primary power prior to servicing.

Table 6-3 MODFPGA Modulation Specific Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
ASI 2 LP	Error on ASI 2 LP in MOD FPGA for DVB	System LED red.	No errors	Input present: Uncorrected byte errors, Corrected byte errors, Buffer overflow Input not present: Hierarchy mode AND ERRW_MODFPGA_PRBS_ON =false
Modulator Illegal Config Mute	Indicates illegal DVB configuration parameters in MOD FPGA	System and Mute LEDs red.	DVB configuration parameters valid	DVB-T: MFN mode: 8k FFT AND 8k interleaver, MIP control AND MIP bad AND no_mip_no_mute = false SFN mode: MIP bad, 8k FFT and 8k interleaver, Storage time < 0.5 us
Modulator Illegal FFT/ Interleaver	Indicates illegal combination of 8k FFT and 8k interleaver in DVB	System LED red.	FFT size of 8k is not used with 8k interleaver mode	FFT size of 8k is set with 8k interleaver mode AND ERRF_MODFPGA_CONFIG_MUTE = true
Modulator DVB Storage Time < .5	Indicates input storage time too low in DVB SFN mode	System LED red.	Storage time > 0.5 us	Storage time <0.5 us AND ERRF_MODFPGA_CONFIG_MUTE = true
Modulator DVB MIP Packet Error	Indicates required MIP packet is bad in DVB	System LED red.	MIP packet is good	MIP packet bad on selected input AND ERRF_MODFPGA_CONFIG_MUTE = true
Modulator Input Frame Timing Unsync	Indicates input circuit has not synchronized in DVB MOD FPGA	System and Mute LEDs red.	DVB MOD FPGA output processing reset line low	DVB MOD FPGA output processing reset line high
Modulator Input A	Indicates input A is present in MOD FPGA. ATSC ASI HPA	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input A selected for primary or auxiliary input
Modulator Input C	Indicates input C is present in MOD FPGA. ATSC ASI LPB	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input C selected for primary or auxiliary input
Modulator Input B	Indicates input B is present in MOD FPGA. ATSC SMPTE A	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input B selected for primary or auxiliary input

WARNING: Disconnect primary power prior to servicing.

Table 6-3 MODFPGA Modulation Specific Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Modulator Input D	Indicates input D is present in MOD FPGA. ATSC SMPTE B	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input D selected for primary or auxiliary input
Modulator Input Signal Loss	Indicates required inputs are not present in MOD FPGA.	System and Mute LEDs red.	Depends on modulation standard. Relevant inputs present.	DVB-T: SFN mode AND hierarchy : Auto switch mode: HP or LP bad on both ASI 1 and ASI 2, Manual switch mode: HP or LP bad on selected input, SFN mode AND non-hierarchy: Auto switch mode: HP bad on both inputs, Manual switch mode: HP bad on selected input
Modulation Mute	Indicates modulator FPGA has muted	System and Mute LEDs red.	Depends on modulation standard. Modulator not muted, other conditions ok	DVB-T: Mute bit set in MOD FPGA
ASI1 HP Rate Overflow/Underflow	Indicates overflow or underflow on ASI 1 HP in MOD FPGA for DVB	System LED red	(overflow bit in DDR1. Reg 15 bit 15 = 0) AND (underflow bit in DDR1. Reg 15 bit 13 = 0)	(overflow bit in DDR1. Reg 15 bit 15 = 1) OR (underflow bit in DDR1. Reg 15 bit 13 = 1)
ASI1 LP Rate Overflow/Underflow	Indicates overflow or underflow on ASI 1 LP in MOD FPGA for DVB	System LED red	(overflow bit in DDR1. Reg 15 bit 14 = 0) AND (underflow bit in DDR1. Reg 15 bit 12 = 0)	Hierarchy mode, (overflow bit in DDR1. Reg 15 bit 14 = 1) OR (underflow bit in DDR1. Reg 15 bit 12 = 1)
ASI2 HP Rate Overflow/Underflow	Indicates overflow or underflow on ASI 2 HP in MOD FPGA for DVB	System LED red	(overflow bit in DDR2. Reg 15 bit 11 = 0) AND (underflow bit in DDR1. Reg 15 bit 9 = 0)	(overflow bit in DDR2. Reg 15 bit 11 = 1) OR (underflow bit in DDR2. Reg 15 bit 9 = 1)
ASI2 LP Rate Overflow/Underflow	Indicates overflow or underflow on ASI 2 LP in MOD FPGA for DVB	System LED red	(overflow bit in DDR2. Reg 15 bit 10 = 0) AND (underflow bit in DDR1. Reg 15 bit 8 = 0)	Hierarchy mode, (overflow bit in DDR2. Reg 15 bit 10 = 1) OR (underflow bit in DDR2. Reg 15 bit 8 = 1)
DAB (modulation specific)				

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Table 6-3 MODFPGA Modulation Specific Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Modulator No Timestamp (FF FFFF)	Indicates timestamp is missing on valid input 1	System LED red.	Timestamp is present	Input is present, but timestamp is missing on input 1
Modulator No Timestamp (FF FFFF)	Indicates timestamp is missing on valid input 2	System LED red.	Timestamp is present	Input is present, but timestamp is missing on input 2
Modulator PFRU Undisciplined	Indicates PFRU PLL is not disciplined for DAB	System LED red.	PFRU PLL is disciplined	PLL is undisciplined AND dynamic delay on AND PLL bypass off
Modulator Unresolved ETI Timing	Indicates ETI timing unresolved	System LED red.	Current input = correct input	Current input = wrong input
DAB: ETI Missing	DAB ETI input missing	System LED orange.	ETI input 1 and 2 present	ETI input 1 OR ETI input 2 missing
DAB: Seamless Not Possible	DAB Seamless switching not possible	System LED orange.	Total delay of input 1 and 2 are equal, Status of input 1 and 2 are equal	(total delay of input 1 and 2 are not equal) OR dynamic delay mode on AND (input status 1 and 2 are not equal)
Modulator Input Signal Loss	Indicates required inputs are not present in MOD FPGA.	System and Mute LEDs red.	Depends on modulation standard. Relevant inputs present.	DAB:
Modulation Mute	Indicates modulator FPGA has muted	System and Mute LEDs red.	Depends on modulation standard. Modulator not muted, other conditions ok	DAB: Software initiated on reset, Mute bit set in MOD FPGA
CTTB/CMMB (modulation specific)				
Modulator Input A	Indicates input A is present in MOD FPGA. ATSC ASI HPA	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input A selected for primary or auxiliary input
Modulator Input C	Indicates input C is present in MOD FPGA. ATSC ASI LPB	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input C selected for primary or auxiliary input
Modulator Input B	Indicates input B is present in MOD FPGA. ATSC SMPTE A	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input B selected for primary or auxiliary input

WARNING: Disconnect primary power prior to servicing.

Table 6-3 MODFPGA Modulation Specific Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Modulator Input D	Indicates input D is present in MOD FPGA. ATSC SMPTE B	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input D selected for primary or auxiliary input
Modulator Input Signal Loss	Indicates required inputs are not present in MOD FPGA.	System and Mute LEDs red.	Depends on modulation standard. Relevant inputs present.	CTTB: SFN mode AND unmute_nosip = false AND selected input not present
Modulation Mute	Indicates modulator FPGA has muted	System and Mute LEDs red.	Depends on modulation standard. Modulator not muted, other conditions ok	CTTB:
ATSC (modulation specific)				
Modulator Input A	Indicates input A is present in MOD FPGA. ATSC ASI HPA	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input A selected for primary or auxiliary input
Modulator Input C	Indicates input C is present in MOD FPGA. ATSC ASI LPB	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input C selected for primary or auxiliary input
Modulator Input B	Indicates input B is present in MOD FPGA. ATSC SMPTE A	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input B selected for primary or auxiliary input
Modulator Input D	Indicates input D is present in MOD FPGA. ATSC SMPTE B	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input D selected for primary or auxiliary input
Modulator Input Signal Loss	Indicates required inputs are not present in MOD FPGA.	System and Mute LEDs red.	Depends on modulation standard. Relevant inputs present.	ATSC:
Modulation Mute	Indicates modulator FPGA has muted	System and Mute LEDs red.	Depends on modulation standard. Modulator not muted, other conditions ok	ATSC:
ISDB-T (modulation specific)				
Modulator Input A	Indicates input A is present in MOD FPGA. ATSC ASI HPA	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input A selected for primary or auxiliary input

WARNING: Disconnect primary power prior to servicing.

Table 6-3 MODFPGA Modulation Specific Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Modulator Input C	Indicates input C is present in MOD FPGA. ATSC ASI LPB	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input C selected for primary or auxiliary input
Modulator Input B	Indicates input B is present in MOD FPGA. ATSC SMPTE A	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input B selected for primary or auxiliary input
Modulator Input D	Indicates input D is present in MOD FPGA. ATSC SMPTE B	System LED red. TS Input LED yellow or red.	MPEG sync indicator = 1	MPEG sync indicator = 0 AND input D selected for primary or auxiliary input
Modulator Input Signal Loss	Indicates required inputs are not present in MOD FPGA.	System and Mute LEDs red.	Depends on modulation standard. Relevant inputs present.	ISDB-T:
Modulation Mute	Indicates modulator FPGA has muted	System and Mute LEDs red.	Depends on modulation standard. Modulator not muted, other conditions ok	ISDB-T:

Table 6-4 EXT I/O & DUC Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
EXT I/O				
External IO Not Alive	Indicates external input option board is in known good state	System LED red.	Data pattern written/read over SPI matches	Data pattern written/read over SPI does not match AND Initial check did match
DUC				
Digital Upconvertor Not Alive	Indicates digital upconverter FPGA is in known good state	System and Mute LEDs red.	Data pattern written/read over HPI matches	Data pattern written/read over HPI does not match

WARNING: Disconnect primary power prior to servicing.

Table 6-4 EXT I/O & DUC Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Digital Upconvertor Temperature	Indicates digital upconverter FPGA is over temperature	System and Mute LEDs red.	Over temperature less than 4 times. 85 C limit.	Over temperature 4 times (no time limit). 85 C limit
Digital Upconvertor Input Signal Zero	DUC input signal level is very low	System and Mute LEDs red.	RMS of signal greater than 0.1 (full scale = +/- 1.0)	RMS of signal less than 0.1 (full scale = +/- 1.0) 5 times in a row (1 second interval)
Digital Upconvertor Temperature Warning	DUC FPGA Temperature over limit	VAX: System LED orange.	DUC FPGA temperature less than 80 degrees C	(DUC FPGA over 80 C OR Temperature reading error) AND ERRF_DUC_FPGA_TEMP = false

Table 6-5 DSP Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Adaptive Correction Linear	DSP reports HPF feedback invalid (required for linear RTAC)	System LED red.	DSP reports HPF feedback ok.	DSP reports HPF feedback invalid.
Adaptive Correction Nonlinear	DSP reports HPA feedback invalid (required for non-linear RTAC)	System LED red.	DSP reports HPA feedback ok.	DSP reports HPA feedback invalid.
Adaptive Correction Linear RF Level High	RF attenuator level is too high for linear	System LED red.	RF attenuator level < 10%	RF attenuator level > 104%
Adaptive Correction Nonlinear RF Level High	RF attenuator level is too high for non-linear	System LED red.	RF attenuator level < 10%	RF attenuator level > 104%
Adaptive Correction Linear RF Level Low	RF attenuator level is too low for linear	System LED orange.	RF attenuator level > 10%	RF attenuator level < 10%
Adaptive Correction Nonlinear RF Level Low	RF attenuator level is too low for non-linear	System LED orange.	RF attenuator level > 10%	RF attenuator level < 10%

WARNING: Disconnect primary power prior to servicing.

Table 6-6 PFRU Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
Frequency Ref. Not Alive	Indicates PFRU is in known good state	System and Mute LEDs red.	Data pattern written/ read over HPI matches and board ID is correct	Data pattern written/ read over HPI does not match or board ID is not correct
Frequency Ref. External 1PPS	External 1 pps is not present when it is required	System and Mute LEDs red.	External 1pps present	SFN mode and external 1pps not present when selected as reference
Frequency Ref. External 10MHz	External 10 MHz is not present when it is required	System and Mute LEDs red.	External 10 MHz present	SFN mode and external 10 MHz not present when selected as reference
Frequency Ref. GPS 1PPS	1pps from internal GPS is not present when it is required	System and Mute LEDs red.	1pps from internal GPS present	SFN mode and 1pps from internal GPS not present when selected as reference
Frequency Ref. IF LO PLL Not Locked	PFRU DAC PLL lock state	System and Mute LEDs red.	DAC PLL lock bit from PFRU FPGA set	DAC PLL lock bit from PFRU FPGA not set
Frequency Ref. RF LO PLL Not Locked	PFRU RF PLL lock state	System and Mute LEDs red.	RF PLL lock bit from PFRU FPGA set	RF PLL lock bit from PFRU FPGA not set
Frequency Ref. PLL Undisciplined	Selected reference for 10 MHz OCXO missing in DAB mode	System and Mute LEDs red.	Reference present	SFN mode and selected reference not present
Frequency Ref. 1PPS	External 1 pps is not present	System LED orange.	External 1pps present	External 1pps not present when selected as reference
Frequency Ref. 10MHz	External 10 MHz is not present	System LED orange.	External 10 MHz present	External 10 MHz not present when selected as reference
Frequency Ref. GPS 1PPS	1pps from internal GPS is not present	System LED orange.	1pps from internal GPS present	1pps from internal GPS not present when selected as reference
Frequency Ref. PLL Undisciplined	Selected reference for 10 MHz OCXO missing in DAB mode	System LED orange.	Reference present	Selected reference not present

WARNING: Disconnect primary power prior to servicing.

Table 6-7 MCU & SYS Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
MCU				
Main Control application update count near limit.	Warning when number of copies of application code is exceeded	System LED orange.	Copies < 105	Copies > 105
SYS				
SYSTEM +1.4VDC	Fault if over voltage	System LED red.	+1.4 V DC	10% above nominal
SYSTEM +1.4VDC	Fault if under voltage	System LED red.	+1.4 V DC	10% below nominal
SYSTEM +3.3VDC	Fault if over voltage	System LED red.	+3.3 V DC	10% above nominal
SYSTEM +3.3VDC	Fault if under voltage	System LED red.	+3.3 V DC	20% below nominal
SYSTEM +5VDC	Fault if over voltage	System LED red.	+5 V DC	10% above nominal
SYSTEM +5VDC	Fault if under voltage	System LED red.	+5 V DC	20% below nominal
SYSTEM +12VDC	Fault if over voltage	System and Mute LEDs red.	+12 V DC	10% above nominal
SYSTEM +12VDC	Fault if under voltage	System and Mute LEDs red.	+12 V DC	10% below nominal
SYSTEM +24VDC	Fault if over voltage	System and Mute LEDs red.	+24 V DC	10% above nominal
SYSTEM +24VDC	Fault if under voltage	System and Mute LEDs red.	+24 V DC	10% below nominal
SYSTEM -12VDC	Fault if over voltage	System and Mute LEDs red.	-12 V DC	< -14.4 V
SYSTEM -12VDC	Fault if under voltage	System and Mute LEDs red.	-12 V DC	> -10.8 V
System Battery Pack	Fault if over voltage	System LED red.	+12 V DC	10% above nominal
System Battery Pack	Fault if under voltage	System LED red.	+12 V DC	20% below nominal
SYSTEM Fan Tach below minimum RPM	Fan tach low for fan 1	System and Drive Chain LED red.	2400 rpm	< 2400 rpm
SYSTEM Fan Tach below minimum RPM	Fan tach low for fan 2	System and Drive Chain LED red.	2400 rpm	< 2400 rpm
SYSTEM DVBT MIP is not OK	DVB-T mode MIP packet missing	System and Mute LEDs red.	MIP packet present	MIP packet missing and DVB-T SFN mode and Unmute On MIP Bad = False
System Hardware Key Invalid	SHA Hardware key authentication fail	System and Mute LEDs red.		

WARNING: Disconnect primary power prior to servicing.

Table 6-7 MCU & SYS Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
SYSTEM Feature Key does not allow modulation	Modulation does not match feature key	All status LEDs red.	Modulation type read from modulator FPGA matches feature key	Modulation type read from modulator FPGA does not match feature key
SYSTEM Feature Key does not allow UAX/ VAX	System is VAX or VAX, but feature key is not correct	All status LEDs red.	System is VAX or VAX, and feature key is correct	Micron Front Panel detected, but VAX or VAX is not enabled in feature key.
SYSTEM FP FPGA programming error	System is VAX, but front panel is not programmed	All LEDs orange.	Front panel is programmed	System is VAX, but front panel programming fails. This is a UAX/VAX specific fault.
SYSTEM AC Loss. UPS Active	SYSTEM AC Loss. UPS Active	System and Mute LEDs red.		
System Max FWD Power Exceeded	System Forward Power has exceeded Max Forward Power setting	System LED red.	Forward Power Threshold setting <= Forward power <= Max Forward Power setting	Forward Power > Max Forward Power setting
System Fwd Power Below Alarm Level	System Forward Power is below Alarm Setting	System LED red.	Forward Power Threshold setting <= Forward power <= Max Forward Power setting	Forward Power < FWD LOW PWR ALARM setting
System VSWR	Software generated VSWR fault	System LED red. Mute LED red.	Nominal Range for VSWR is scaled by F/ B Threshold user setting, settable from 1-4%. This equates to approximately a 1.2:1 to 1.5:1 VSWR range	Trip point is set by user: F/B Trip Level, settable from 5-10%
50W not supported by Amp Ctrl Rev A.0	Orion - Amp Control Rev A.0 doesn't support 50W	System LED red. Mute LED red.	VAX50-C must run on Amp Controller Board Rev A.1 or higher	VAX50-C and Amp Control Board Rev A.0
SYSTEM +12VDC Battery	Fault if over voltage	System LED orange.	+12 V DC	8% above nominal
SYSTEM +12VDC Battery	Fault if under voltage	System LED orange.	+12 V DC	18% below nominal
SYSTEM Fan Tach below minimum RPM	Fan tach low for fan 1	System and Drive Chain LED orange.	Between 2880 rpm and 23040 rpm	(2400 rpm < fan tach < 2880 rpm) OR (fan tach > 23040 rpm)
SYSTEM Fan Tach below minimum RPM	Fan tach low for fan 2	System and Drive Chain LED orange.	Between 2880 rpm and 23040 rpm	(2400 rpm < fan tach < 2880 rpm) OR (fan tach > 23040 rpm)

WARNING: Disconnect primary power prior to servicing.

Table 6-7 MCU & SYS Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
SYSTEM Foldback active	Power fold back warning	System LED orange.	Power foldback = 0	Power foldback > 0
SYSTEM Temporary Feature Key Installed	Test Feature enabled in Feature Key. Feature Key will last for 24 hours, when 24 hrs elapses, Invalid Modulation Feature Fault will be activated.	System LED orange.	Test Feature disabled in Feature Key	Test Feature enabled in Feature Key.
SYSTEM Slave mode when TCU not present	Micron System is in slave mode and no TCU presence is detected.	System LED orange.	Micron System is in Master Mode, or system is in Slave Mode and TCU presence detected.	System is in Slave Mode, and TCU Present command not asserted on Pin 19 of the Top 25 pin Connector on the VAX-C. This is a UAX/VAX specific fault.
SYSTEM in Reduced Power Mode	% of FWD Power Reference setting < 100%	System LED orange.	% of FWD Power Reference = 100%	% of FWD Power Reference setting < 100% This is a UAX/VAX specific fault.

6.3.1 PA Faults

Table 6-8 PA Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
RF Output Level exceeding +6dBm	RF Output Level fault	Drive Chain LED red.	RF Output ADC <=2125 (+6dBm)	RF Output ADC > 2125 (+6dBm)
Amp Ctrl Driver Current Fault	Amp Controller Driver Current Fault	Drive Chain LED red.	200mA - 450mA	< 175mA or > 500mA
Amp Ctrl PS Fault	45V Power Supply Fault	Drive Chain LED red.	43V - 47V	> 40V
Amp Ctrl PA FET 1 Bias Fault	50V Current 1 Fault	Drive Chain LED red.	25W Amp: >= 300mA 50W Amp: >= 425mA	25W Amp: < 250mA 50W Amp: < 375mA
Amp Ctrl PA FET 2 Bias Fault	50V Current 2 Fault	Drive Chain LED red.	25W Amp: >= 300mA 50W Amp: >= 425mA	25W Amp: < 250mA 50W Amp < 375mA

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Table 6-8 PA Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
PA Thermal Shutdown	PA Hardware Thermal Shutdown Fault	Drive Chain LED red.	< 80.0 C	Approximately 86 C trip point
PA Overvoltage Fault	PA Overvoltage Fault	Drive Chain LED red.	43-47V	51V trip point
PA FET 1 Overcurrent Fault	PA Overcurrent Fault on FET 1	Drive Chain LED red.	25W Amp: < 2A 50W Amp: < 5A	25W Amp: 2A trip point 50W Amp: 5A trip point
PA FET 2 Overcurrent Fault	PA Overcurrent Fault on FET 2	Drive Chain LED red.	25W Amp: < 2A 50W Amp: < 5A	25W Amp: 2A trip point 50W Amp: 5A trip point
PA VSWR Fault	PA VSWR Fault	Drive Chain LED red.	Nominal Range for VSWR is scaled by F/B Threshold user setting, settable from 1-4%. This equates to approximately a 1.2:1 to 1.5:1 VSWR range	10dB down from full power, or approx a 2:1 VSWR
PA Temperature Fault	S/W PA Temperature fault	Drive Chain LED red.	PA 1 and PA 2 Temp < 80.0 C	Fault declared when PA 1 or PA 2 Temp >= 85.0 C. Fault clears when both PA 1 and PA 2 Temperature <= 75.0 C
RF Input Level Low Fault	RF Input Level Low Fault	Drive Chain LED red.	GFX: -2dBm +/-1dBm Cabinet Controller: 0dBm +2/-3dBm	GFX: RF Level In < -4dBm Cabinet Controller: RF Level In < -6dBm
Low RF Gain Fault	RF Gain Low Fault	Drive Chain LED red.	During normal RF ALC operations (TX On, unmuted), PA FWD PWR detector should be >= 1000	Fault declared during normal RF ALC operations if no faults present on Amp Control Board, and PA FWD PWR Detector < 1000
Amp Ctrl Driver Current Warning	Amp Controller Driver Current Warning	Drive Chain LED orange.	200mA - 450mA	175mA <= Driver Current < 200mA or 450 < Driver Current <= 500mA
Amp Controller PS Warning	45V Power Supply Warning	Drive Chain LED orange.	43V - 47V	40V <= PS Voltage < 43V or PS Voltage > 47V
Amp Controller PA FET 1 Bias Warning	50V Current 1 Warning	Drive Chain LED orange.	25W Amp: >= 300mA 50W Amp: >= 425mA	25W Amp: 250mA <= Current < 300mA 50W Amp: 375mA <= Current < 425mA
Amp Controller PA FET 2 Bias Warning	50V Current 2 Warning	Drive Chain LED orange.	25W Amp: >= 300mA 50W Amp: >= 425mA	25W Amp: 250mA <= Current < 300mA 50W Amp: 375mA <= Current < 425mA

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Table 6-8 PA Faults

Fault Log Message	Fault Description	Front Panel LEDs	Nominal Value/ Scaling	Trip Level
PA Temperature Warning	PA Temperature Warning	Drive Chain LED orange.	PA 1 and PA 2 Temp < 80.0 C	80.0 C <= PA 1 or PA 2 Temp < 85.0 C
RF Input Level Low Warning	RF Input Level Low	Drive Chain LED orange.	GFX: -2dBm +/-1dBm Cabinet Controller: 0dBm +2/-3dBm	GFX: -4dBm <= RF Level In < -3dBm Cabinet Controller: -6dBm <= RF Level In < -3dBm
RF Input Level High Warning	RF Input Level High	Drive Chain LED orange.	GFX: -2dBm +/-1dBm Cabinet Controller: 0dBm +2/-3dBm	GFX & Cabinet Controller: RF Level In > 2dBm

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WARNING: Disconnect primary power prior to servicing.

Section 7 Parts List 7

7.1 Replaceable Parts List

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Table 7-1 FORMAT, XMTR, PLATINUM, VAX CC, 5W-250W - 995 0337 001 ((C))

Harris PN	Description	Qty UM	Reference Designators
620 3014 000	ADAPTER, SMA JACK-JACK BULKHEAD	0 EA	
628 0024 000	ADAPTER, 7/16-JACK TO N-JACK	0 EA	
634 0424 000	POWER METER	0 EA	
646 1355 000	NAMEPLATE, XMTR EQUIPMENT	0 EA	
880 0068 001	TP, UAX LPU/ UAC-C XMTR	0 DWG	
943 5602 592	BASIC 24RU	0 EA	
952 9265 036	CABLE, EXTERNAL	0 EA	
952 9265 037	CABLE, EXTERNAL	0 EA	
952 9265 038	CABLE, EXTERNAL	0 EA	
952 9265 039	CABLE, EXTERNAL	0 EA	
9710035030G	KIT, GPS OPTION	0 EA	
9710035031G	KIT, SFN OPTION	0 EA	
9710051011G	ASM-POWER MODULE	0 EA	
9710051012G	KIT, 1 MIN UPS, 15 MIN HOLDOVER OPTION	0 EA	
9710051032GT	ASSY, AC/DC CONVERTER (TESTED)	0 EA	
9710051033G	KIT, ADJUSTABLE RACK RAILS	0 EA	
9710051037G	KIT, ATSC OPTION	0 EA	
9710051038G	KIT, DVB T/H OPTION	0 EA	
9710051039G	KIT, MPH OPTION	0 EA	
9710051040G	KIT, CTTB OPTION	0 EA	
9710051041G	KIT, ISDB-TB OPTION	0 EA	
9710051043G	KIT, DVB T2 OPTION	0 EA	
971 0051 050	VHF AMPLIFIER MODULE	1 EA	
9810031023G	RACK, 37RU BASIC UAX	0 EA	
9810031027G	KIT, 37RU, FRONT AIR PLENUM	0 EA	
981 0090 094	KIT, GPS ANT & CBL TNC TO SMA	0 EA	
9810126014G	ASSY, IPA, ASI OVER IP	0 EA	
9810126016G	ASSY, IPZ, ASI OVER IP	0 EA	
9810126113G	ASSY, SRD6800+, SAT RECEIVER, W/ASI IN	0 EA	
9810126115G	ASSY, SRZ6800+, SAT RECEIVER, W/ASI IN	0 EA	
981 0155 001	XMTR, PLATINUM, BASIC, COMPACT CLASS VHF	1 EA	
981 0155 002	XMTR, PLATINUM, BASIC, COMPACT CLASS VHF	0 EA	
9810274013G	ASSY, DAB ETI INPUT OPTION, CC	0 EA	
9810274014G	ASSY, DAB EDI/IP INPUT OPTION, CC	0 EA	
988 2857 001	DOC PACKAGE, PLATINUM VAX, COMPACT CLASS, ENGLISH	1 EA	

Table 7-2 KIT, 1 MIN UPS, 15 MIN HOLDOVER OPTION - 9710051012G (C1)

Harris PN	Description	Qty UM	Reference Designators
302 0803 006	SCREW, MACH M3-0.5 X 6 SEMS	4 EA	
660 0179 000	BATT PK, CUSTOM, ITERNA 100304	1 EA	

Table 7-3 KIT, ATSC OPTION - 9710051037G (A)

Harris PN	Description	Qty UM	Reference Designators
861 1153 032	SW/FW ATSC COMPLETE APP	0 DWG	
9710035014G	ASM-SUB-BLANK PANEL B	1 EA	

Table 7-4 KIT, DVB T/H OPTION - 9710051038G (A)

Harris PN	Description	Qty UM	Reference Designators
861 1153 042	SW/FW DVB COMPLETE APP	0 DWG	
9710035014G	ASM-SUB-BLANK PANEL B	1 EA	

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Table 7-5 KIT, MPH OPTION - 9710051039G (A)

Harris PN	Description	Qty UM	Reference Designators
861 1153 032	SW/FW ATSC COMPLETE APP	0 DWG	
9710035014G	ASM-SUB-BLANK PANEL B	1 EA	

Table 7-6 KIT, CTTB OPTION - 9710051040G (A)

Harris PN	Description	Qty UM	Reference Designators
861 1153 072	SW/FW CTTB COMPLETE APP	0 DWG	
9710035014G	ASM-SUB-BLANK PANEL B	1 EA	

Table 7-7 KIT, ISDB-TB OPTION - 9710051041G (A)

Harris PN	Description	Qty UM	Reference Designators
861 1153 062	SW/FW ISDB-T COMPLETE APP	0 DWG	
9710035014G	ASM-SUB-BLANK PANEL B	1 EA	

Table 7-8 KIT, DVB T2 OPTION - 9710051043G (B)

Harris PN	Description	Qty UM	Reference Designators
302 0803 006	SCREW, MACH M3-0.5 X 6 SEMS	6 EA	
861 1153 082	SW/FW DVB-T2 COMPLETE	0 DWG	
9010215281G	*PWA, DVB-T2 FPGA EXPANSION	1 EA	
9710035014G	ASM-SUB-BLANK PANEL B	1 EA	

Table 7-9 VHF AMPLIFIER MODULE - 971 0051 050 (B)

Harris PN	Description	Qty UM	Reference Designators
000 0000 010	B/M NOTE:	0 DWG	
055 0100 005	*THERMAL COMPOUND, 8OZ JAR	0 EA	
302 0803 001	SCREW, SEMS M2.5 X 8 SKT HD,SS	9 EA	
302 0803 006	SCREW, MACH M3-0.5 X 6 SEMS	17 EA	
303 7103 008	SCREW SKT HD CAP M3 X 8	2 EA	
315 0021 030	LOCKWASHER, SPLIT M3 SST (DIN127)	2 EA	
350 0114 000	RIVET 0.125 DIA, DOME HEAD, CLOSED END	4 EA	
380 0843 000	N-MOSFET, BLF881 (SOT467C)	1 EA	Q1
381 0075 000	MOSFET,N-CHANNEL, MRFE6VP5600H	1 EA	Q2
408 0397 000	GASKET,EMI,11.8MM X 10.7MM, V	9.5 IN	
410 0490 025	STANDOFF, HEX 25MM M3 M/F AL	7 EA	
626 0165 000	RECP, N PANEL FLANGE JACK	1 EA	J2
646 0665 000	LABEL, INSPECTION	1 EA	
901 0230 051	PWA, BIII PA 881/E5600	1 EA	
943 5613 101	BRACKET, PA MOUNTING	1 EA	
943 5613 177	HEATSINK, VHF PA	1 EA	
943 5613 178	AMPLIFIER COVER VHF	1 EA	
943 5613 180	BRACKET, HEAT SINK MTG	1 EA	
952 9265 033	CABLE PACKAGE, PA COMPLETE	1 EA	

Table 7-10 PWA, BIII PA 881/E5600 - 901 0230 051 (B)

Harris PN	Description	Qty UM	Reference Designators
000 0000 010	B/M NOTE:	0 DWG	
506 0245 000	CAP, 0.33UF 63VDC 5%	2 EA	C27 C30
518 0118 204	CAP, VAR 0.45-4PF 1000V RT ANG	1 EA	C28
540 1600 101	RES 10 OHM 3W 5%	2 EA	R1 R2
540 1600 213	RES 330 OHM 3W 5%	2 EA	R3 R4
610 1401 040	HDR, 40C 2ROW VERTICAL (SYS 50)	1 EA	J5
801 0230 051	SCH, BIII PA 881/E5600	0 DWG	
901 0230 052	PWA, BIII PA 881/E5600 SMT & BASIC THRU	1 EA	

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943 5567 060	INDUCTOR, SERIES	1 EA	L1
943 5567 061	INDUCTOR, SHUNT	1 EA	L2
943 5567 320	COIL, 1-1/2 TURNS	1 EA	L6
943 5567 514	BALUN, BAND III	2 EA	Z1 Z2
943 5567 928	ASSY, COIL 1-1/2 TURNS	1 EA	L5

Table 7-11 PWA, BIII PA 881/E5600 SMT & BASIC THRU - 901 0230 052 (B)

Harris PN	Description	Qty UM	Reference Designators
000 0000 010	B/M NOTE:	0 DWG	
358 2997 000	END PLATE, GREY (236)	1 EA	TB1C
381 0029 000	N-MOSFET, 2N7002	1 EA	Q4
383 0218 000	IC, MIC1555 (SOT23-5)	1 EA	U8
383 0277 001	IC LM4040CIM3-4.1 ESD	1 EA	CR1
383 0678 000	IC, INA168	1 EA	U2
383 0817 000	IC AD8362	2 EA	U3 U4
383 0823 000	IC, 74LVC1G125	7 EA	U10 U11 U12 U13 U16 U17 U18
383 0996 000	IC, AD8652AR	2 EA	U5 U6
383 1021 000	IC, AD7888 ESD	1 EA	U15
383 1073 000	IC, TQP3M9009 (SOT-89)	1 EA	U1
383 1270 000	IC, LT1963A-3.3 (SOT-223)	1 EA	U7
385 0027 000	DIODE, SCHOTTKY, HSMS-2800	2 EA	CR2 CR3
393 0081 000	*CPLD, XC95144XL (TQFP-100)	1 EA	U9
393 0092 000	EEPROM, AT25128A (SOIC-8)	1 EA	U14
496 0088 015	IND CHIP 0.10UH 0805 10%	1 EA	L4
496 0093 109	IND, AIR 22NH 2% 1812 SMT	1 EA	L3
515 0040 000	*CAP 33PF 1206 C0G 50V 5%	1 EA	C43
515 0128 000	*CAP 0.01UF 1206 X7R 100V 10%	1 EA	C36
515 0136 417	*CAP 0.047UF 0805 X7R 100V 10%	2 EA	C94 C95
515 0136 501	*CAP 0.1UF 0805 X7R 50V 10%	10 EA	C44 C45 C46 C47 C48 C49 C50 C51 C88 C89
515 0137 501	*CAP 0.1UF 1206 X7R 50V 10%	6 EA	C16 C19 C24 C25 C26 C81
515 0138 501	CAP 0.1UF 1812 X7R 100V 10%	5 EA	C17 C18 C97 C98 C99
515 0179 213	CAP 330PF 0603 C0G 50V 5%	2 EA	C91 C92
515 0180 317	CAP 4700PF 0603 X7R 50V 10%	1 EA	C52
515 0180 401	CAP 0.01UF 0603 X7R 50V 10%	2 EA	C100 C101
515 0180 501	CAP 0.1UF 50V 10% X7R 0603	13 EA	C1 C102 C103 C104 C105 C106 C107 C108 C109 C110 C111 C112 C113
515 0189 000	CAP 22UF 1206 X5R 6.3V 20%	3 EA	C4 C5 C21
515 0197 000	*CAP 1UF 25V 10% 0805 X5R	1 EA	C40
515 0348 000	CAP 2.2UF 10% 100V X7R	1 EA	C114
515 0430 000	CAP CER .1UF 0402 16V 10%	32 EA	C15 C53 C54 C55 C56 C57 C58 C59 C60 C61 C62 C63 C64 C65 C66 C67 C68 C69 C70 C71 C72 C73 C74 C75 C76 C77 C78 C79 C80 C115 C116 C117
519 0167 023	CAP RF CHIP 8.2PF +-0.1PF 500V	1 EA	C12
519 0167 101	CAP RF CHIP 10PF 2% 500V	1 EA	C20
519 0167 103	CAP RF CHIP 12PF 2% 500V	1 EA	C31
519 0167 109	CAP RF CHIP 22PF 2% 500V	5 EA	C10 C11 C13 C14 C82
519 0167 115	CAP RF CHIP 39PF 2% 500V	1 EA	C93
519 0167 119	CAP RF CHIP 56PF 2% 500V	2 EA	C41 C42
519 0176 223	CAP RF CHIP 820PF 2% 50V	4 EA	C6 C7 C8 C9

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519 0202 111	CAP RF CHIP 27PF 1% 250V	1 EA	C37
519 0202 119	CAP RF CHIP 56PF 1% 250V	2 EA	C2 C3
519 0208 102	CAP RF CHIP 11PF 2% 500V	4 EA	C32 C33 C38 C39
523 0003 101	CAP 10UF 35V 20% SMT	4 EA	C22 C23 C34 C35
523 0070 210	CAP 220UF 63V 20% 105C LOW-Z	1 EA	C90
523 0070 217	CAP 470UF 63V 20% 16MM 105C	1 EA	C29
545 0308 301	RES 1K OHM 1% 1/8W 0805	2 EA	R12 R24
545 0308 306	RES 1.62K OHM 1% 1/8W 0805	1 EA	R11
545 0308 323	RES 8.25K OHM 1% 1/8W 0805	2 EA	R25 R26
545 0308 414	RES 35.7K OHM 1% 1/8W 0805	2 EA	R30 R74
545 0308 510	RES 237K OHM 1% 1/8W 0805	1 EA	R10
545 0309 301	RES 1K OHM 1% 1/4W 1206	1 EA	R17
545 0309 408	RES 20K OHM 1% 1/4W 1206	1 EA	R19
545 0309 601	RES 1M OHM 1% 1/4W 1206	2 EA	R83 R84
545 0309 999	RES 0 OHM JUMPER 1206	1 EA	R85
545 0310 019	RES 5.62 OHM 1% 1W 2512	1 EA	R73
545 0310 307	RES 1.82K OHM 1% 1W 2512	4 EA	R20 R21 R22 R23
545 0310 801	RES 0.010 OHM 1% 1W 2512	1 EA	R8
545 0310 925	RES 0.500 OHM 1% 1W 2512	4 EA	R6 R7 R15 R16
545 0327 000	RES, 0.010 OHM 1W 1%	2 EA	R9 R88
545 0331 201	RES 100 OHM 1% 1/10W 0603	3 EA	R27 R28 R29
545 0331 318	RES 5.11K OHM 1% 1/10W 0603	1 EA	R13
545 0331 523	RES 825K OHM 1% 1/10W 0603	2 EA	R77 R78
545 0331 601	RES 1MEG OHM 1% 1/10W 0603	1 EA	R60
545 0331 999	RES 0 OHM JUMPER 0603	2 EA	R75 R76
545 0369 101	RES 10 OHM 1% 1/16W 0402	1 EA	R33
545 0369 109	RES 22.1 OHM 1% 1/16W 0402	2 EA	R14 R18
545 0369 201	RES 100 OHM 1% 1/16W 0402	26 EA	R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59
545 0369 401	RES 10K OHM 1% 1/16W 0402	24 EA	R61 R62 R63 R64 R65 R66 R67 R68 R69 R70 R71 R72 R100 R101 R102 R103 R110 R111 R112 R113 R120 R121 R122 R123
545 0369 505	RES 150K OHM 1% 1/16W 0402	1 EA	R5
545 0369 999	RES 0 OHM JUMPER 0402	4 EA	R130 R131 R132 R133
551 0017 205	TRIMPOT 500 OHM 1/4W 4MM SQ	4 EA	R79 R80 R81 R82
551 0017 401	TRIMPOT 10K OHM 1/4W 4MM SQ	2 EA	R86 R87
559 0055 000	THERMISTOR, 50K OHM 5% 1206	4 EA	RT1 RT2 RT3 RT4
610 1070 000	HDR, 6C VERT 2ROW UNSHR	1 EA	J9
610 1334 000	HDR, 3C VERT 1ROW 1-WALL	1 EA	J7
610 1401 040	HDR, 40C 2ROW VERTICAL (SYS 50)	1 EA	J6
611 0016 000	HEADER, 14C, 2MM, VERTICAL	1 EA	J8
614 0790 000	TERM BLK, PCB, 1-POLE, GREY (236)	2 EA	TB1A,TB1B
620 3028 000	*RECP,MALE SMA PC MOUNT RT ANG	3 EA	J1 J3 J4
646 2110 000	BARCODE, SN_ITEM_REV	1 EA	BARCODE
801 0230 051	SCH, BIII PA 881/E5600	0 DWG	
801 0230 053	PWB, BIII PA 881/E5600	1 EA	

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Table 7-12 CABLE PACKAGE, PA COMPLETE - 952 9265 033 (B)

Harris PN	Description	Qty UM	Reference Designators
843 5613 084	CABLE DIAGRAMS, ORION	0 DWG	
952 9265 002	CABLE PACKAGE, PA	1 EA	
952 9265 022	CABLE #21	1 EA	
952 9265 023	CABLE #22	1 EA	

Table 7-13 KIT, GPS ANT & CBL TNC TO SMA - 981 0090 094 (B)

Harris PN	Description	Qty UM	Reference Designators
742 0020 000	ANTENNA, GPS PANASONIC CCAH32ST01	1 EA	
742 0171 000	KIT, GPS ANT MOUNTING	1 EA	
917 2573 048	CABLE, GPS 50 OHM TNC:SMA 100FT	1 EA	

Table 7-14 ASSY, IPA, ASI OVER IP - 9810126014G (C1)

Harris PN	Description	Qty UM	Reference Designators
735 0067 000	PWA, IPA6800+	1 EA	
880 0274 006	TP, ASI OVER IP TEST INSTRUCTION	0 DWG	
9810126036G	ASSY, CARRIER, IPA\IPZ6800+ CARD, UAX CC	1 EA	

Table 7-15 ASSY, IPZ, ASI OVER IP - 9810126016G (B1)

Harris PN	Description	Qty UM	Reference Designators
735 0069 000	PWA, IPZ6800+	1 EA	
880 0274 006	TP, ASI OVER IP TEST INSTRUCTION	0 DWG	
9810126036G	ASSY, CARRIER, IPA\IPZ6800+ CARD, UAX CC	1 EA	

Table 7-16 ASSY, SRD6800+, SAT RECEIVER, W/ASI IN - 9810126113G (A)

Harris PN	Description	Qty UM	Reference Designators
302 0803 010	SCREW, MACH M3-0.5 X 10 SEMS	2 EA	
33-351	EMI CLIP, SMALL SINGLE	3 EA	
344 0117 000	SCREW, M3.5 X 8 PPH SELF-TAP	4 EA	
344 0252 000	SCREW, M3X6L SELF TAP PH PHIL	2 EA	
410 0501 000	STANDOFF, 1" PCB EDGE CLIP MNT	4 EA	
460 0006 000	BRACKET, PCB MTG BLOCK RT ANGL	2 EA	
735 0066 000	PWA, SRD6800+	1 EA	
880 0274 005	TP, SAT RECEIVER TEST INSTRUCTION	0 DWG	
9010233153G	*PWA, SRD/SRZ BACKPLANE W/ ASI IN	1 EA	
943 5613 157	CHASSIS, SRD/SRZ-6800 CARD	1 EA	
952 9248 101	CABLE, EXTERNAL RECLOCKER	2 EA	
9710051018G	*PWA, UAX CC 6800 INTERFACE (TOP LEVEL)	1 EA	
9810126013GWI	WI, SRD/SRZ SATELLITE RECEIVER, ORION	0 DWG	

Table 7-17 ASSY, SRZ6800+, SAT RECEIVER, W/ASI IN - 9810126115G (A)

Harris PN	Description	Qty UM	Reference Designators
302 0803 010	SCREW, MACH M3-0.5 X 10 SEMS	2 EA	
33-351	EMI CLIP, SMALL SINGLE	3 EA	
344 0117 000	SCREW, M3.5 X 8 PPH SELF-TAP	4 EA	
344 0252 000	SCREW, M3X6L SELF TAP PH PHIL	2 EA	
410 0501 000	STANDOFF, 1" PCB EDGE CLIP MNT	4 EA	
460 0006 000	BRACKET, PCB MTG BLOCK RT ANGL	2 EA	
735 0068 000	PWA, SRZ6800+	1 EA	
880 0274 005	TP, SAT RECEIVER TEST INSTRUCTION	0 DWG	
9010233153G	*PWA, SRD/SRZ BACKPLANE W/ ASI IN	1 EA	
943 5613 157	CHASSIS, SRD/SRZ-6800 CARD	1 EA	
952 9248 101	CABLE, EXTERNAL RECLOCKER	2 EA	

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9710051018G	*PWA, UAX CC 6800 INTERFACE (TOP LEVEL)	1 EA
9810126013GWI	WI, SRD/SRZ SATELLITE RECEIVER, ORION	0 DWG

Table 7-18 XMTR, PLATINUM, BASIC, COMPACT CLASS VHF - 981 0155 001 (A)

Harris PN	Description	Qty UM	Reference Designators
053 0016 000	CARTON, TRIPLE WALL, 28X25X10.5	0 EA	
302 0803 008	SCREW, MACH M3-0.5 X 8 SEMS	3 EA	
306 0028 000	LOCKNUT, TOOTHWASHER M4-0.7MM	2 EA	
356 0004 000	CABLE CLAMP, NYLON 0.250" DIA	1 EA	
646 0665 000	LABEL, INSPECTION	1 EA	
943 5588 081	INSERT, M2X TOP PACKING	0 EA	
943 5588 082	INSERT, M2X BOTTOM PACKING	0 EA	
971 0051 001	ASSY, ORION BASIC	1 EA	
971 0077 001	XMTR, VHF, COMMON ACCESSORIES	1 EA	
9810126004GWI	WI, ORION TRANSMITTER / GAP FILLER	0 DWG	

Table 7-19 ASSY, ORION BASIC - 971 0051 001 (T)

Harris PN	Description	Qty UM	Reference Designators
026 6010 007	GROMMET STRIP, 0.063	1.3 FT	
086 0001 002	*ADHESIVE, THREADLOCK 242	0 EA	
086 0001 004	SEALANT, HIGH STRENGTH	0 EA	
165-601-000	SCREW A M3X 6 ST/ZN CROSS H3	2 EA	
302 0803 006	SCREW, MACH M3-0.5 X 6 SEMS	8 EA	
302 0803 010	SCREW, MACH M3-0.5 X 10 SEMS	1 EA	
302 0804 008	SCREW, MACH M4-0.7 X 8 SEMS	11 EA	
303 4103 006	SCREW, MACH M3-0.5 X 6	4 EA	
303 4104 016	SCREW, MACH M4-0.7 X 16	1 EA	
303 4104 050	SCREW, PHMS M4-0.7 X 50 SST	4 EA	
303 4203 006	SCREW, FHMS M3-0.5 X 6	16 EA	
306 0028 000	LOCKNUT, TOOTHWASHER M4-0.7MM	5 EA	
307 0001 040	NUT, STD HEX M4-0.7 (SST)	2 EA	
310 0037 000	WASHER, FLAT #4 SST (ANSI REGULAR)	2 EA	
311 0011 030	WASHER, FLAT M3 SST (DIN125)	4 EA	
311 0011 040	WASHER, FLAT M4 SST (DIN125)	4 EA	
315 0021 030	LOCKWASHER, SPLIT M3 SST (DIN127)	4 EA	
315 0021 040	LOCKWASHER, SPLIT M4 SST (DIN127)	4 EA	
315 0023 040	WASHER, EXT LOCK M4	3 EA	
325 0020 000	LOCKNUT, HEX KEP M3-0.5 (SST)	5 EA	
336 1330 000	STDOFF-M/F-4.5MM HEX-M3X0.5X5L	9 EA	
350 0058 000	RIVET 0.125 DIA, CSINK HEAD, CLOSED END	7 EA	
350 0114 000	RIVET 0.125 DIA, DOME HEAD, CLOSED END	14 EA	
356 0004 000	CABLE CLAMP, NYLON 0.250" DIA	2 EA	
356 0087 000	CABLE TIE TY RAP	12 EA	
358 1214 000	SCREWLOCK, M/F 4-40X3/16"	2 EA	
358 2628 000	CABLE PUSH MOUNT	9 EA	
396 0261 000	DISPLAY, LCD BLUE	1 EA	
408 0338 000	GASKET, EMI, 0.13 TALL X 0.19	1.143 EA	
424 0001 000	GROMMET 0.375 GROOVE DIA	3 EA	
430 0325 000	FAN GUARD, 80MM WIRE-FORM	2 EA	
430 0687 000	FAN, 80MM X 32MM 12VDC	2 EA	
610 1425 003	RECP, 3C 1ROW VERTICAL	2 EA	
727 1519 002	GROMMET, LIGHT PIPE	7 EA	
727 1519 003	LIGHT PIPE, 0.2" L X 0.190" DIA CLEAR	7 EA	
778-225-004	HOLE BUNG DP-312	1 EA	
9010213011G	*PWA, MCF5484 UC MODULE	1 EA	
9010223091G	*PWA, FRONT PANEL	1 EA	

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943 5588 030	BLOCK-MOUNTING-PCA_UEP	3 EA
943 5588 059	RAMP. M2X AIR	1 EA
943 5588 062	BRACKET, AC CORD	1 EA
943 5613 004	ORION, CHASSIS	1 EA
943 5613 007	FRONT CONTROL PANEL COVER	1 EA
943 5613 009	CHASSIS, COVER	1 EA
943 5613 017	AIR DIVIDER PANEL	1 EA
943 5613 022	FRONT PANEL SHIELD	1 EA
943 5613 023	CHASSIS, BRACE	1 EA
943 5613 029	FRONT PANEL MOUNTING BRACKET	1 EA
943 5613 036	BRACKET, CONNECTOR	1 EA
943 5613 041	ASSY, ORION FRONT PANEL	1 EA
952 9248 010	CABLE, GROUND	1 EA
9710051011G	ASM-POWER MODULE	1 EA
9710051032G	ASSY, AC/DC CONVERTER	1 EA
9710051035G	KIT, CE COMPLIANCE	1 EA

Table 7-20 ASSY, ORION FRONT PANEL - 943 5613 041 (B)

Harris PN	Description	Qty UM	Reference Designators
843 5613 041	ASSY, ORION FRONT PANEL	0 DWG	
943 5613 006	CHASSIS FRONT PANEL	1 EA	
943 5613 040	RETAINER, ORION FRONT FILTER	2 EA	
943 5613 062	FILTER, ORION AIR	2 EA	

Table 7-21 XMTR, VHF, COMMON ACCESSORIES - 971 0077 001 (B)

Harris PN	Description	Qty UM	Reference Designators
086 0001 002	*ADHESIVE, THREADLOCK 242	0 EA	
256 0227 000	CABLE, FFC 40C, 2ROW 61MM LONG	3 EA	
302 0803 006	SCREW, MACH M3-0.5 X 6 SEMS	11 EA	
306 0028 000	LOCKNUT, TOOTHWASHER M4-0.7MM	2 EA	
311 0011 060	WASHER, FLAT M6 SST (DIN125)	2 EA	
358 1214 000	SCREWLOCK, M/F 4-40X3/16"	2 EA	
410 0471 000	STANDOFF, HEX M3 X 16 M/F	6 EA	
414 0399 000	SUPPRESSOR, SPLIT FERRITE	1 EA	
9010215181G	*PWA, SIGNAL PROCESSOR	1 EA	
943 5602 519	AIR DEFLECTOR	1 EA	
952 9265 032	CABLE PACKAGE, XMTR COMPLETE	1 EA	
9710035011G	ASM-SUB-TX/IO INTERFACE MODULE	1 EA	
9710051016G	ASM-SUB-PFRU	1 EA	
971 0077 002	ASSY, UDC VHF	1 EA	

Table 7-22 *PWA, SIGNAL PROCESSOR - 9010215181G (H)

Harris PN	Description	Qty UM	Reference Designators
360 0073 000	HEAT SINK, 40X40X13 MM BLACK	1 EA	#U40
360 0073 001	HEAT SINK, 30X30X10 MM BLACK	1 EA	#U43
404 1007 000	HOLDER, BATTERY 20MM COIN CELL	1 EA	BT1
410 0492 006	STANDOFF, PEM, M3-0.5 X 6 (KFSE-M3-6)	2 EA	
445 0055 000	OCXO, 54MHZ, 3.3V HCMOS ESD	1 EA	U61
516 0054 000	CAP, DISC 0.001UF 1KV 10% Z5U	4 EA	C2 C6 C189 C204
610 0900 000	HDR, 3C VERT 1ROW UNSHR	1 EA	JP1
610 1110 000	HDR, 8C VERT 2ROW UNSHR	1 EA	J7
610 1401 040	HDR, 40C 2ROW VERTICAL (SYS 50)	3 EA	J23 J24 J25
610 1402 020	*HDR (FFC), 20C 2ROW RT ANG	1 EA	J18
612 1184 000	JUMPER SHUNT, 2C, 0.1" PITCH	1 EA	1/JP1
612 2152 000	RECP, RJ45 W/ INTEGRAL LED	2 EA	J1 J20
612 2243 009	RECP/RECP, D, 9C/9C, METAL	1 EA	J5

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612 2342 000	RECP, 80C, RT-ANG, BD-BD	2 EA	J21 J22
612 2347 000	RECP, MCX FEMALE 50 OHMS	10 EA	J2 J3 J13 J14 J15 J16 J17 J19 J26 J27
620 2930 000	RECEPTACLE RT ANGLE BNC	1 EA	J6
626 0005 000	RECP, BNC, STACKED, THRU-PANEL, 50 OHM	1 EA	J4
646 2110 000	BARCODE, SN_ITEM_REV	1 EA	
660 0054 000	BATTERY 3V LITHIUM COIN CR2032	1 EA	#BT1
801 0215 181	SCH, SIGNAL PROCESSING	0 DWG	
9010215182G	*PWA, SIGNAL PROCESSOR, SMT	1 EA	
9306-0014	CONN HDR,2X7 POS .10CTRS	1 EA	J9

Table 7-23 XMTR, PLATINUM, BASIC, COMPACT CLASS VHF - 981 0155 002 (A)

Harris PN	Description	Qty UM	Reference Designators
981 0155 001	XMTR, PLATINUM, BASIC, COMPACT CLASS VHF	1 EA	

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